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NEW ENGLAND DIV NOV 79

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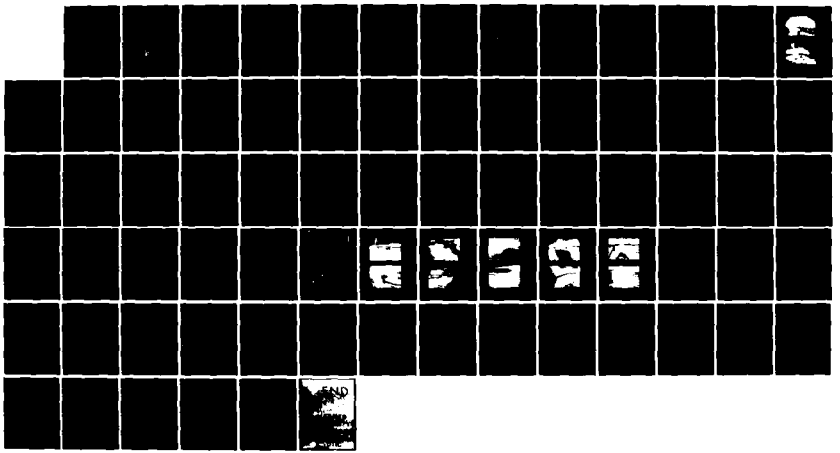
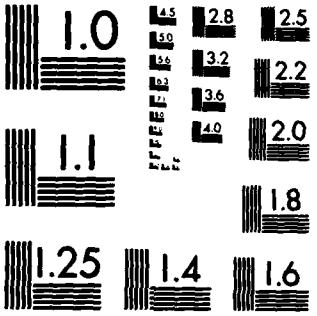


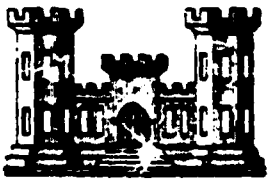


THAMES RIVER BASIN
BOZRAH, CONNECTICUT

GARDNER LAKE DAM

CT. 00512

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Thames River Basin
Bozrah, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Gardner Lake Dam is an earth embankment with a shallow concrete wall that extends nearly across the full length of the upstream face. The dam is about 168 ft. long and is about 9.6 ft. high. The dam is judged to be in fair condition. The test flood inflow equals 4,600 cfs. The size classification, which is based on the storage volume, is intermediate. The dam has been classified as having a significant hazard potential. The range for the test flood is ½ PMF to a full PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM MASSACHUSETTS 02154

REPLY TO
ATTENTION OF

FEB 4 1986

NEDED

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Gardner Lake Dam Phase 1 Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

GARDNER LAKE

CT 00512

THAMES RIVER BASIN
BOZRAH, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	CT 00512
Name of Dam:	Gardner Lake Dam
Town:	Bozrah
County and State:	New London County, Connecticut
Stream:	Gardner Brook
Date of Inspection:	9 and 24 October 1979

BRIEF ASSESSMENT

Gardner Lake Dam is an earth embankment with a shallow concrete wall that extends nearly across the full length of the upstream face. The dam is about 168 ft. long and is about 9.6 ft. high. The top width of the dam varies from about 72 ft. near its left abutment to 154 ft. near its right abutment. A secondary road passes over the crest of the dam near the downstream face. The dam has two concrete spillways. The service spillway is located near the left abutment and has a net weir crest length of 11.5 ft. A combined auxiliary spillway and outlet structure is located near the right abutment. The auxiliary spillway's crest is slightly higher than the service spillway and has a net weir crest length of 12 ft. The regulating outlet is controlled by a 3 ft. square sluice gate.

The lake behind the dam is about 9,400 ft. long and has a surface area at spillway level of about 521 acres. The drainage area above the dam is 5.63 sq. mi. and the maximum storage to the top of dam is estimated at about 3,270 acre-ft. The size classification, which is based on the storage volume, is intermediate. Failure of the dam may cause appreciable economic loss and loss of a few lives, and thus the dam has been classified as having a significant hazard potential. Based on intermediate size and significant hazard, the range for the test flood is ½ PMF to a full PMF. The selected test flood for the project is ½ PMF.

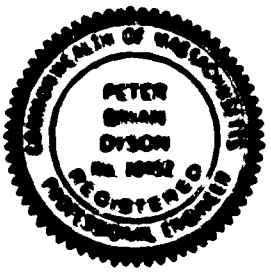
The dam is judged to be in fair condition. There was no evidence of seepage and the dam appeared to be generally well maintained. There are cracks in the concrete approach training walls of the service spillway, and the embankment just right of the right training wall showed signs of settlement. Voids were also evident adjacent to both approach training walls. The combined auxiliary spillway and outlet structure, reconstructed in 1969, was found to be in good condition, but there appeared to be erosion of the earth embankment immediately downstream of the structure. Brush growth was noted on a small berm along the rim of the reservoir to the left of the dam and in the discharge channel of the auxiliary spillway. There was one large elm tree on the dam embankment.

The test flood inflow equals 4,600 cfs. The routed test flood outflow of 1,000 cfs overtops the non-overflow sections of the dam by 1.15 ft. The spillways can pass 235 cfs or about 24 percent of the routed test flood outflow without overtopping the dam.

Within one year after receipt of this Phase I Inspection Report, the owner, the State of Connecticut, Department of Environmental Protection, should: (1) assess further the potential for overtopping and the adequacy of the spillways; (2) investigate the settlement of the embankment to the right of the service spillway and the potholes and voids in the embankment adjacent to the training walls; (3) investigate the structural cracks in the concrete training walls of the service spillway and the settlement and cracking of the concrete wall on the upstream face of the embankment where it intersects the right training wall; and (4) investigate the erosion immediately downstream of the auxiliary spillway and design appropriate stilling basin and slope protection.

The owner should also implement the following operating and maintenance measures: (1) remove brush growth from the berm to the left of the dam and in the discharge channel of the auxiliary spillway, and remove a large elm tree from the embankment; (2) repair erosion to the riprapped slope at the end of the southeast wing wall of the roadway culvert in the service spillway discharge channel; (3) repoint mortar joints in the downstream training walls of the main spillway; (4) complete and implement the formal surveillance and flood warning plan that is in the process of being developed; and (5) institute procedures for an annual periodic technical inspection of the dam.

Peter B. Dyson
Project Manager



This Phase I Inspection Report on Gardner Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

RICHARD BISHOP, MEMBER
Water Control Branch
Engineering Division

ARAKNET MARTERIAN, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. WEIR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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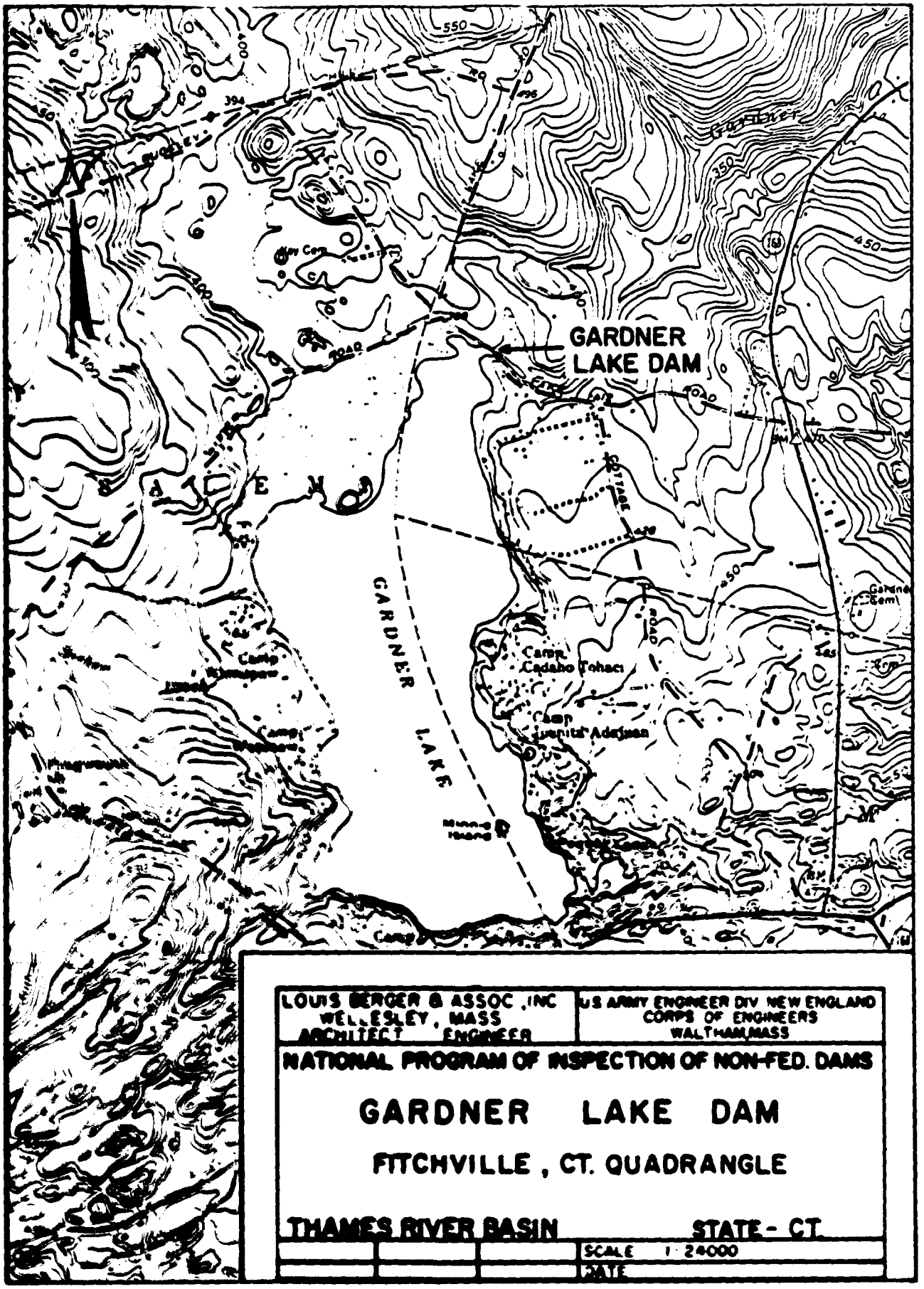
Overview from Right Abutment

Overview from Left Abutment


GARDNER
LAKE DAM
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LOUIS BERGER & ASSOC., INC
WELLESLEY, MASS
ARCHITECT ENGINEER
U.S ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
GARDNER LAKE DAM
FITCHVILLE, CT. QUADRANGLE
THAMES RIVER BASIN
STATE - CT.
SCALE 1:24000
DATE

PHASE I INSPECTION REPORT

GARDNER LAKE DAM CT 00512

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 28 September 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-79-C-0051, Job Change No. 2, has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Gardner Lake is located in the Towns of Salem, Montville and Bozrah, Connecticut, and is the headwaters of Gardner Brook. Gardner Lake Dam is situated at the northeast corner of Gardner Lake in the Town of Bozrah, New London County, Connecticut. The dam site is about 4.9 miles upstream from Gardner Brook's confluence with the Yantic River and is shown on U.S.G.S. Quadrangle, Fitchville, Connecticut, with coordinates approximately at N 41° 31' 31", W 72° 13' 21".

b. Description of Dam and Appurtenances. Gardner Lake Dam is an earth fill dam about 9.6 ft. high and 168 ft. long, constructed across a shallow valley reach on Gardner Brook. The top width of the dam varies from about 72 ft. near its left abutment to about 154 ft. near its right abutment. Lake Road passes across the dam adjacent to its downstream face, the road embankment serving as part of the dam. The dam is essentially a low spillage - low surcharge facility and the impounded waters are used for recreation. A shallow vertical faced concrete wall extends along about 105 ft. of the upstream face of the dam. The remainder of the upstream face has a variable slope which averages about 1½ horizontal to 1 vertical. The crest of the dam slopes downward slightly from the

upstream face of the dam to Lake Road. Along the reservoir rim to the left of the dam there is a small berm about 3 ft. higher than normal water surface, which extends for a distance of about 96 ft. The right abutment of the dam abuts onto a small recreational facility situated on the shore of the lake.

Two spillways have been constructed within the dam embankment. The service spillway is located about 30 ft. from the left abutment; it is a broad crested concrete weir which tapers in width from its upstream end to its downstream end. The spillway is 11.5 ft. wide at its narrowest point. About 42 ft. to the left of the right abutment there is a concrete combined spillway and outlet structure with a crest height about 0.2 ft. higher than the service spillway. This auxiliary straight drop spillway has two openings, the left opening being 8 ft. wide and the right one about 4 ft. wide. The two openings are separated by a concrete pier which, together with the end walls, supports a concrete walkway across the spillway. Below the 4 ft. spillway opening there is a low level outlet which is controlled by a 3 ft. x 3 ft. sluice gate.

Outflows from the two spillways are conducted across the dam in two separate open channels, which pass under Lake Road via two culverts, one for each channel. Beyond the right culvert, outflows from the auxiliary spillway and outlet gate enter a manmade channel constructed of stone masonry. Outflows from the service spillway enter a natural channel after passing through the left culvert. Between these two channels, the upstream face of the dam and Lake Road, the crest of the dam (which has a slight depression) serves as a parking area for visitors.

c. Size Classification. Gardner Lake Dam is about 9.6 ft. high, impounding a storage of 1,945 acre-ft. to spillway crest level and about 3,270 acre-ft. to top of dam. In accordance with size and capacity criteria promulgated in the Recommended Guidelines for Safety Inspection of Dams, capacity governs and the project is categorized in the intermediate classification.

d. Hazard Classification. A breach failure of the dam at Gardner Lake would release water down Gardner Brook leading to the Yantic River. Lake Road which crosses the dam would be severed. Between the dam and Scott Hill Road, a distance of about 2 miles, the brook is narrow and steep dropping about 140 ft. in 11,000 ft. There are no structures within this reach of the brook and no property damage is anticipated above Scott Hill Road. At Scott Hill Road it is anticipated that the roadway would be flooded and that one house located on the east side of the Scott Hill Road crossing of the brook would sustain damage due to flooding. Beyond Scott Hill Road the brook is joined by several others, and it meanders along a course which is much flatter in slope, dropping about 80 ft. in a distance of about 13,700 ft. It is not anticipated that there would be any property damage in this reach of the brook arising from a breach of the dam.

In summary, Lake Road, Scott Hill Road and one house on Scott Hill Road would be expected to sustain damage in the event of failure of the dam, and that there is a potential for the loss of a few lives. Consequently, Gardner Lake Dam has been classified as having a significant hazard potential in accordance with the Recommended Guidelines for the Safety Inspection of Dams.

e. Ownership. The dam is owned by the State of Connecticut, Department of Environmental Protection, Room 207, State Office Building, Hartford, Connecticut 06115.

f. Operator. Mr. John Olson, Regional Manager, Region IV Headquarters, Connecticut Department of Environmental Protection, RFD 1, Sheldon Road, Voluntown, CT 06384. Telephone: (203) 376-2513.

g. Purpose of Dam. The dam impounds a lake used for recreational purposes.

h. Design and Construction History. It is not known by whom the dam was designed or constructed. A 1966 inspection report by the State of Connecticut, Water Resources Commission, notes that it was thought that the original dam might have been constructed around the year 1900. The dam is believed to have been partially rebuilt in 1969. Plans of the 1969 reconstruction of the dam indicate that the existing drawdown structure was removed and replaced with a new structure that serves as a combined auxiliary spillway and low level outlet; that the portion of the upstream wall between the two spillways received a new cap; that the outlet channel from the new spillway was reconstructed; and, that the channel from the service spillway received riprap protection on its left side. Copies of the plans showing this work can be found in Appendix B.

i. Normal Operating Procedures. There are no formal operational procedures for Gardner Lake Dam. The low level outlet gate is used in the fall of the year to draw down the lake for the benefit of shoreline property owners.

1.3 Pertinent Data

a. Drainage Area. The drainage area contributing to Gardner Lake is situated at the headwaters of Gardner Brook. The drainage area encompasses a total of about 5.63 sq. mi. (3,603 acres), of which 521 acres are occupied by the lake. The longest circuitous stream course contributing to the lake is about 12,400 ft. long with an elevation difference of about 76 ft., or at a slope of about 32 ft. per mile. The drainage area has a length of about 2.08 miles and a maximum width of about 3.98 miles. The basin consists of both open fields and forested areas, with sparse population, and the terrain is best described as rolling. Several youth camps are located on the shores of the lake.

b. Discharge at Damsite

(1) Outlet Works Conduit. Low level discharges from Gardner Lake are provided for by a 3 ft. x 3 ft. sluice gate which is controlled by a hand operated, screw stemmed slide. It is estimated that with the gate wide open the outlet would be capable of discharging about 144 cfs when the lake water surface was at test flood level. With the water level at top of dam, the discharge capacity would be about 133 cfs with the gate wide open.

(2) Maximum Known Flood at Damsite. No records are available of flood inflows into Gardner Lake nor of spillway releases and surcharge heads during such inflows.

(3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity at top of dam, elevation 386.25, is 235 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity is about 460 cfs at test flood elevation 387.4 MSL.

(5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable

(6) Gated Spillway Capacity at Test Flood Elevation. Not applicable

(7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at the test flood elevation is the same as (4) above, 460 cfs at elevation 387.4 MSL.

(8) Total Project Discharge at Test Flood Elevation. The total project discharge at test flood is 1,000 cfs at elevation 387.4 MSL.

c. Elevations (Ft. above NGVD)

(1) Streambed at centerline of dam - Left Stream 377.7
Right Stream 376.7

(2) Maximum tailwater - Not available

(3) Upstream portal invert diversion tunnel - Not applicable

(4) Recreation pool - 384.0

(5) Full flood control pool - Not applicable

(6) Ungated spillway crest - Left spillway 384.0
Right Spillway 384.2

(7) Design surcharge (original design) - Unknown

(8) Top of dam - 386.25

(9) Test flood design surcharge - 387.4

d. Reservoir

(1) Length of maximum pool - 9,400 ft.

(2) Length of recreation pool - 9,350 ft.

(3) Length of flood control pool - Not applicable

e. Storage (acre-ft.)

(1) Recreation pool - El. 384.0 - 1945

(2) Flood control pool - Not applicable

(3) Spillway crest pool El. 384.0 - 1,945

(4) Top of dam El. 386.25 - 3,270

(5) Test flood pool El. 387.4 - 4,030

f. Reservoir Surface (acres)

(1) Recreation pool El. 384.0 - 521

(2) Flood control pool - Not applicable

(3) Spillway crest El. 384.0 - 521

(4) Top of dam El. 386.25 - 641

(5) Test flood pool El. 387.4 - 703

g. Dam

(1) Type - Earth fill

(2) Length - 168 ft.

(3) Height - 9.6 ft.±

(4) Top width - Varies

(5) Side slopes - Downstream: varies, but all on slight slope
Upstream: vertical concrete wall

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

h. Diversion and Regulating Tunnel - Not applicable

i. Spillway

(1) Type - Left: Main Spillway - broad crested concrete weir
Right: Auxiliary Spillway - straight drop concrete weir

(2) Length of weir - Left - 11.5 ft., Right 12 ft.

(3) Crest elevation - Left 384.0, Right 384.2

(4) Gates - None

(5) Upstream channel - Reservoir

(6) Downstream channel - Natural river channel (left)
- Manmade channel (right)

j. Regulating Outlets

(1) Invert - 377.5

(2) Size - 3 ft. x 3 ft. square opening

(3) Description - One opening just right of auxiliary spillway

(4) Control Mechanism - Hand operated, screw type slide gate.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No data on the design of the original dam or appurtenances has been recovered and probably none exists. Two plans have been obtained showing some proposed reconstruction work which is believed to have been carried out in 1969. At that time the dam was owned by the State of Connecticut, State Board of Fisheries and Game, which retained the services of Macchi and Hoffman, Engineers, of Hartford, Connecticut to perform engineering services for the repair of Gardner Lake Dam. The two plans showing the repair work can be found in Appendix B.

2.2 Construction Data

No records or correspondence regarding construction have been found, with the exception of a State Inspection Report that noted the dam was reconstructed in 1969.

2.3 Operation Data

The dam is operated by the State of Connecticut, Department of Environmental Protection. There appear to be no formal records.

2.4 Evaluation of Data

a. Availability. Since no pertinent engineering data is available, it is not possible to make an assessment of the safety of the embankment. The basis of the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Gardner Lake Dam took place on 9 and 24 October 1979. On 9 October the water was about 0.1 ft. above the right spillway crest and about 0.3 ft. above the left spillway crest. The combined discharge over the spillways was estimated to be about 10 cfs. There was no evidence of any major maintenance problems, but a few items require attention (see Section 7.3). The dam was judged to be in fair condition.

b. Dam. The dam is a low surcharge - low spillage facility, impounding a lake which is used for recreation. It is an earth fill dam with a shallow vertical concrete wall along most of its upstream face. It is about 9.6 ft. high and 168 ft. long, the top width varying from about 72 ft. near its left abutment to about 154 ft. near its right abutment. Lake Road passes across the dam near its downstream face. The crest of the dam slopes downward slightly from the upstream face to Lake Road.

It is conjectured that the roadway embankment existed before the dam was built and that when the dam was constructed, earth fill was placed between the upstream concrete wall and the roadway, thus forming one earth structure. Along the reservoir rim to the left of the dam there is a small berm about 3 ft. higher than normal water surface, about 96 ft. long. The berm was covered with brush and saplings.

There was no evidence of any seepage coming from the earth embankment. This is undoubtedly due to the great width of the embankment in comparison to its height, particularly in the central portion, so that any seepage would be well below ground and not observable.

There was a 3 ft. diameter elm tree on the dam embankment, located about 20 ft. from the upstream face, between the two spillways.

c. Appurtenant Structures. There are two spillways in the upstream face of the dam, both of which are constructed of concrete. The service spillway has a net weir crest length of 11.5 ft. and is located about 30 ft. from the left abutment. It is a broad crested weir with converging approach walls (see Photograph No. 7). The auxiliary straight drop spillway has a net weir crest length of 12 ft. and a crest about 0.2 ft. higher than the service spillway. It is located near the right abutment in a combined spillway and outlet structure containing the regulating outlet for the lake, controlled by a 3 ft. by 3 ft. sluice gate. The structure has two side walls and a center pier, separating the outlet gate section on the right side from the overflow section on the left (see Photograph No. 1), and a footbridge over it.

Photograph No. 2 is a general view of the concrete wall to the left of the service spillway, showing cracks in the concrete, which is in poor condition. There were also cracks in the concrete wall to the right of the spillway and mortar is missing from the masonry training walls on the downstream side (see Photograph

Nos. 4 and 5). The earth embankment between the service spillway and the left abutment is contained on the downstream side by a rubble masonry wall with no mortar in the joints. The rubble masonry wall is only a few feet downstream of the concrete wall, and is about 1.5 ft. high (see Photograph No. 6). Just to the left of the service spillway and downstream of the concrete wall there are some potholes measuring approximately 2 ft. by 1 ft. (Photograph No. 3).

Photograph No. 8 shows a low area in the embankment behind the right approach training wall to the service spillway. This may have been caused by settlement or the loss of fines. This settlement may also be related to the settlement of the concrete wall on the upstream side of the embankment next to the right training wall of the spillway.

The outlet channel from the service spillway passes through a concrete box culvert under Lake Road (Photograph No. 9). Erosion has taken place on the right side of the channel at the end of the concrete wingwall. The outlet channel for the auxiliary spillway and low level outlet is slightly lower than the other channel. This channel is riprap protected and leads to a corrugated metal pipe with masonry arch culvert under Lake Road, shown in Photograph No. 10, which also shows the vegetation that was growing in the channel.

The general condition of the combined auxiliary spillway and outlet structure was good. The regulating outlet for the dam consists of a 3 ft. square sluice which is controlled by a slide gate. The manual operating mechanism for the outlet gate appeared to be in good condition, but was not demonstrated. It was reported to be operating. There was some erosion of the earth embankment on both sides of the downstream channel adjacent to the structure (Photograph No. 1).

d. Reservoir Area. The lake behind the dam is a ponding of Gardner Brook which is used for recreational purposes. Numerous summer camps and youth camps are located along the shorelines of the lake. Most of the shore is gently sloping and there was no evidence of slides or other problems.

e. Downstream Channel. Below the culvert openings under Lake Road, the spillway discharges from Gardner Lake flow in two separate channels which join together a short distance downstream of the dam. The discharge channel for the service spillway culvert is a natural channel. The channel downstream of the auxiliary spillway culvert is manmade with vertical rubble masonry walls. For about two miles downstream of the dam to Scott Hill Road, the brook is narrow and drops at a rate of about 67 ft. per mile. Beyond Scott Hill Road the slope of the brook is about 31 ft. per mile. In this reach the brook's valley is somewhat wider and more valley storage space is available. About 4.8 miles below the dam Gardner Brook joins the Yantic River.

3.2 Evaluation

In general, the visual inspection of the dam adequately revealed key characteristics of the project as they may relate to its stability and integrity, permitting an assessment to be made of those features affecting the safety of the structure. There was no evidence of seepage and the dam appeared to be generally well maintained. There was some brush growth on the berm on the reservoir rim adjoining the left abutment and in the discharge channel below the auxiliary spillway. There were cracks in the upstream concrete wall and in the training walls of the service spillway, and the embankment just right of the right training wall showed signs of settlement. There appeared to be voids in the embankment adjacent to both training walls. A large elm tree was growing on the dam embankment between the two spillways. Gardner Lake Dam was therefore judged to be in fair condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The State of Connecticut, Department of Environmental Protection, is the owner and operator of the dam. There is a low level outlet for the dam which is operative. There are no documented operating procedures for the dam. The lake is usually drawn down each fall for the benefit of shoreline property owners.

4.2 Maintenance of Dam

There is no specific maintenance program in effect at Gardner Lake Dam. Maintenance is performed as needed by State forces. Required maintenance consists of periodic cutting of grass and brush on the crest of the dam, cutting of brush in the discharge channels and along the berm to the left of the dam, and repair of concrete and masonry structures.

4.3 Maintenance of Operating Facilities

The only operating facility at this dam is the slide gate in the outlet structure. It appears that maintenance to the gate has been performed in the past to keep the mechanism operative.

4.4 Description of any Warning System in Effect

No warning system is in effect at Gardner Lake Dam. However, the Connecticut Department of Environmental Protection is in the process of developing a formal warning system for the facility.

4.5 Evaluation

The facility has simple operating devices and therefore requires no detailed operating procedures. Maintenance involves periodic growth removal from the embankment and surveillance regarding seeps, slope damage, animal burrows, etc. The operating gate requires checking and repairs should be made as necessary. The concrete and masonry walls should be inspected periodically and repaired as necessary. The formal warning system under development should be implemented as soon as possible.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Gardner Lake Dam is an earth embankment with a shallow upstream vertical concrete wall, impounding a normal storage of about 1,965 acre-ft. with provision for an additional 1,325 acre-ft. of capacity in its surcharge space to the top of the dam. It is basically a low spillage - low surcharge facility used for recreational purposes. Its two spillways are capable of discharging about 235 cfs with surcharge to the top of the dam. The general topographic characteristic of the 5.63 sq. mi. drainage basin is best described as rolling terrain. The drainage area measures about 2.08 miles long and 3.98 miles wide and rises from elevation 384.0 at spillway crest to elevation 580 MSL. The area is generally forested.

b. Design Data. No hydrologic or hydraulic design data was retrieved for Gardner Lake Dam, except for that which is shown on the proposed reconstruction plans in Appendix B.

c. Experience Data. No records are available in regard to past operation of the dam, nor of surcharge encroachments and spills through the spillways. The maximum past inflows are unknown.

d. Visual Observations. No evidence which would indicate possible high flows through the lake area or in the downstream channels was noted.

e. Test Flood Analysis. Gardner Lake area and capacity curves and tables, for use in flood routing, are shown on Sheets D-2 and D-3, Appendix D. For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on U.S.G.S. 2,000 ft. per in. quadrangle sheets.

The test flood chosen to evaluate the hydrologic and hydraulic capacity of Gardner Lake Dam was selected in accordance with the criteria presented in the Recommended Guidelines for Safety Inspection of Dams. Since this dam is classified as intermediate in size with a significant hazard potential, a test flood with a range of ½ PMF to a full PMF could be selected for the evaluation. Because only two secondary roads and one house would be affected, a test flood of ½ PMF was selected.

Precipitation data was obtained from Hydrometeorological Report No. 33, which for the Connecticut area approximates 24.0 in. of 6 hour point rainfall over a ten square mile area. This value was then reduced 20 percent to allow for basin size, shape and fit factors. The 6 hour rainfall was distributed into one hour incremental periods as suggested in COE Publication EC 1110-2-1411. A constant loss factor of 0.4 in. was deducted from the precipitation value to give excess rainfall used to prepare an inflow hydrograph.

A triangular incremental unitgraph was assumed for the inflow hydrographs, using a computed lag time value of 3.64 hours (see computations on Sheets D-8 thru D-11, Appendix D), indicating a peak inflow of about 9,200 cfs for a full PMF, 4,600 cfs for a ½ PMF or a CSM of about 817 for a ½ PMF.

Discharge tables and curves for the spillway and for over the top of the dam are shown on Sheets D-4 thru D-6, Appendix D.

A reservoir flood routing was performed for the test flood. The results of this routing are shown on Sheet D-12 and are summarized below as follows:

Test Flood Magnitude	Test Flood Inflow cfs	Max. Res. El. Ft. MSL	Max. Head Over Dam Ft.	Routed Test Flood Outflow cfs
½ PMF	4,600	187.4	1.15	1,000

From the above table, it can be seen that the project will not pass the routed test flood outflow without overtopping the dam by 1.15 ft. However, the spillways can pass about 24 percent of the routed test flood outflow without overtopping the dam.

f. Dam Failure Analysis. As discussed above, the dam would be overtopped by the routed test flood outflow. Also, a breach owing to structural failure of the dam by piping or sloughing is a possibility. For this analysis a breach was assumed with the water level at top of dam. The "rule of thumb" criteria suggested in the NED March 1978 Guidance Report was used for the failure analysis. With a breach width of 40 percent of the dam length, or about 67 ft., an outflow of about 3,570 cfs, which includes 235 cfs from the spillways, would be realized (see Sheets D-13 thru D-15, Appendix D).

Lake Road, which crosses the dam, would be severed. Between the dam and Scott Hill Road downstream, a distance of about 2 miles, Gardner Brook follows a narrow ravine dropping at a rate of 140 ft. in about 11,000 ft. No structures are located within this reach and no property damage should occur within it. At Scott Hill Road it is anticipated that the roadway would be flooded out where the stream crosses the road. Also, one house located at the southeast corner of the roadway crossing would probably sustain flood damage, with a potential for the loss of a few lives. It is estimated that the brook would rise about 4.75 ft. above the level expected from the spillway discharge before failure of the dam.

Beyond Scott Hill Road, the brook is joined by several other streams, meanders more, and is on a much flatter slope as it works its way to the Yantic River about 4.8 miles below the dam. An inspection of this reach indicated that no further significant property damage would occur along the brook, although the discharges would not be greatly retarded by valley storage until the flows reached the Yantic River.

In summary, Lake Road would be severed, Scott Hill Road and one house would sustain significant damage, should a breach of the dam occur with the lake level at the top of dam.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. There are no design calculations, as-built drawings or other data which would permit the preparation of structural stability computations based on assumed soil properties and engineering factors. The dam is now stable but is in only fair condition. Deficiencies described in Section 7 should be corrected.

The field investigation of the service spillway revealed the following:

(1) Significant structural cracks in the concrete training walls.

(2) Settlement of the earth embankment crest to the right of the spillway.

(3) Small potholes and voids in the embankment adjacent to the right and left training walls.

(4) Settlement and cracking of the vertical concrete wall on the upstream side of embankment where it intersects the right training wall.

(5) Roots of the elm tree extend to the right training wall and to the upstream face of the dam.

b. Design and Construction Data. No plans or calculations of value to a stability assessment are available for the dam which was constructed about 1900.

c. Operating Records. There are no operating records of any significance to structural stability.

d. Post Construction Changes. There are no records of any post construction changes made to the dam embankment. The 1969 repairs described in Section 1.2.h. should not adversely affect the stability of the dam.

e. Seismic Stability. The dam is located in Seismic Zone No. 1 and in accordance with recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Gardner Lake Dam appears to be in fair condition. The deficiencies revealed indicate that a further investigation should be carried out and that some remedial work is needed. The major concerns with the overall integrity of the dam are as follows:

(1) The two spillways will only pass about 24 percent of the routed test flood outflow.

(2) There are significant structural cracks in the concrete training walls of the service spillway and in the concrete wall on the upstream face of the dam in the vicinity of the right training wall.

(3) Settlement of the earth embankment to the right of the service spillway and small potholes and voids in the embankment adjacent to the approach training walls.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Investigations. Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner, the State of Connecticut, Department of Environmental Protection, should utilize the services of a competent registered professional engineer to make further investigations of the following, and should implement the results:

(1) Make a thorough study of the hydrology of the drainage basin and evaluate further the potential for overtopping and the inadequacy of the spillways.

(2) Investigate the settlement of the earth embankment crest to the right of the service spillway and the potholes and voids in the embankment adjacent to the right and left training walls.

(3) Investigate the structural cracks in the concrete training walls of the service spillway and the settlement and cracking of the concrete wall on the upstream face of the embankment where it intersects the right training wall.

(4) Investigate the erosion of the earth embankment on both the left and right downstream sides of the auxiliary spillway, and design appropriate stilling basin and slope protection.

7.3 Remedial Measures

a. Operation and Maintenance Procedures:

(1) Insure operability of regulating outlet gate.

(2) Remove brush growth on the berm on the left abutment and in the discharge channel of the secondary spillway. Remove a large elm tree growing on the embankment and backfill with suitable material.

(3) Repair erosion to the riprapped slope at the end of the southeast wing wall of the roadway culvert over the service spillway discharge channel.

(4) Repoint mortar joints in the downstream training walls of the service spillway.

(5) Complete and implement the formal surveillance and flood warning plan that is in the process of being developed.

(6) Institute procedures for an annual periodic technical inspection of the dam.

7.4 Alternatives

There are no meaningful alternatives to the above recommendations and remedial measures.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Gardner Lake Dam

DATE 9 and 24 October 1979

TIME 1:30 PM

WEATHER 9 OCT 1979 Cloudy/Cool
24 OCT 1979 Cloudy/Rain

W.S. ELEV. 384.2 U.S. _____ DN.S.

PARTY:

1. Peter B. Dyson	LBA*	6.	
2. Pasquale E. Corsetti	LBA	7.	
3. Roger F. Berry	LBA	8.	
4. Carl J. Hoffman	LBA	9.	
5. William S. Zoino	GZD	10.	

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrologic	Roger F. Berry	
2.	Hydraulics/Structures	Carl J. Hoffman	
3.	Soils and Geology	William S. Zoino	
4.	General Features	Peter B. Dyson	
5.	General Features	Pasquale E. Corsetti	
6.			
7.			
8.			
9.			
10.			

*LBA - Louis Berger & Associates, Inc.
GZD - Goldberg, Zoino, Dunnicliff & Assoc., Inc.

PERIODIC INSPECTION CHECKLIST

PROJECT Gardner Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Earth Fill Dam NAME William Zoino

DISCIPLINE Soils/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	386.25
Current Pool Elevation	384.2
Maximum Impoundment to Date	Unknown
Surface Cracks	None evident
Pavement Condition	N.A.
Movement or Settlement of Crest	None evident
Lateral Movement	None
Vertical Alginment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Sink hole behind training wall of left spillway.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Yes. Vehicular traffic allowed on slope & crest.
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None evident
Unusual Embankment or Downstream Seepage	None evident
Piping or Boils	None evident
Foundation Drainage Features	None
Toe Drains	None evident
Instrumentation System	None

PERIODIC INSPECTION CHECKLIST

PROJECT Gardner Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Outlet Structure NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	None
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	None
Condition at Joints	Good
Drain Holes	None present
Channel	Outlet channel is the same channel as outlet channel for right spillway (see next page).
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECKLIST

PROJECT Gardner Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Spillways NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS	
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	Left Spillway	Right Spillway
a. Approach Channel	None	None
General Condition	N.A.	N.A.
Loose Rock Overhanging Channel	N.A.	N.A.
Trees Overhanging Channel	N.A.	N.A.
Floor of Approach Channel	N.A.	N.A.
b. Weir and Training Walls		
General Condition of Concrete	Fair	Good
Rust or Staining	Minor	None
Spalling	Minor	None
Any Visible Reinforcing	None	None
Any Seepage or Efflorescence	None	None
Drain Holes	None	None
c. Discharge Channel		
General Condition	Good	Good ; slope erosion below spillway struc.
Loose Rock Overhanging Channel	None	None
Trees Overhanging Channel	None	None
Floor of Channel	Natural	Rip Rap
Other Obstructions	None	Light brush growth

PERIODIC INSPECTION CHECKLIST

PROJECT: Gardner Lake Dam **DATE:** 9 and 24 October 1979

AREA EVALUATED	CONDITIONS
Dike Embankment	N.A.
Outlet Works - Control Tower	N.A.
Outlet Works - Intake Structure & Intake Channel	N.A.
Outlet Works - Transition & Conduit	N.A.
Outlet Works - Service Bridge	N.A.

APPENDIX B

ENGINEERING DATA

FORM D--

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
State Office Building
Hartford, Connecticut

APPLICATION FOR CONSTRUCTION PERMIT FOR Dam

Owner: State Board of Fisheries and Game Date: August 25, 1969

Address: State Office Building

Hartford, Connecticut Tel. No.: 566-2287

Location of Structure:

Town: Bozrah Shown on USGS Quadrangle: Fitchville

Name of Stream: Gardner Brook
Dam at Gardner Lake

at _____ inches south of Lat. _____ north
and _____ inches east of Long. _____ west

Directions for reaching site from nearest village or route intersection:
(Use sketch on reverse side)

North on Route 163 - 1-1/4 mile from Route 82, West on Lake Road, one mile

This is an application for: [redacted] (Alteration) (Repair) [redacted]
(check one or more of above)

This pond is to be used for: General Recreation

Dimensions of Pond: width 1800 ft. length 7200 ft. area 487 acres

Maximum depth of water immediately above dam: 7 feet

Total length of dam: 165 ft.

Height of spillway: 11.5 ft. and 13.0 ft.

Height of abutments above spillway: 2 feet

Type of spillway construction: concrete

Type of dike construction: earth with concrete wall

Spillway section will be set on: [redacted] (Creek) [redacted]
(check one of above)

Remarks: Repairs to existing dam on Gardner Lake.

Two sets of plans included.

STATE WATER RESOURCES COMMISSION
RECEIVED
AUG 25 1969
ANSWERED
REFERRED
FILED

Signed: Richard Homes
(owner)

Name of Engineer, if any: Macchi and Hoffman, Engineers

Note: Show details of construction on reverse side

B-1

14

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

IV-2

5

CT 512

No. ______

Inventoried By ______

Date Nov. 7 1966

Name of Dam or Pond Gardners Lake

Code No. ______

Nearest Street Location ______

Town Bozrah   Long 72-13.9

U.S.G.S. Quad. Fitchville

Name of Stream ______   Lat 41-31.5

Owner State Board of Fisheries & Game

Address State Office Bldg.
Hartford

DA 6.56 sm

Pond Used For Recreation (control of stream flow at one time)

Dimensions of Pond: Width ______ Length ______ Area 486.8

1900? rebuilt 1969

Total Length of Dam 150'± Length of Spillway 25'+9'+12'

Location of Spillway West end of dam (control gates on East end)

Height of Pond Above Stream Bed 8'

Height of Embankment Above Spillway 2 ft.

Type of Spillway Construction concrete, ogee

Type of Dike Construction concrete wall with some stone ... and earth downstream

Downstream Conditions ... top of dam 1 ft above normal water level ...

72 ... bridge for spillway ...

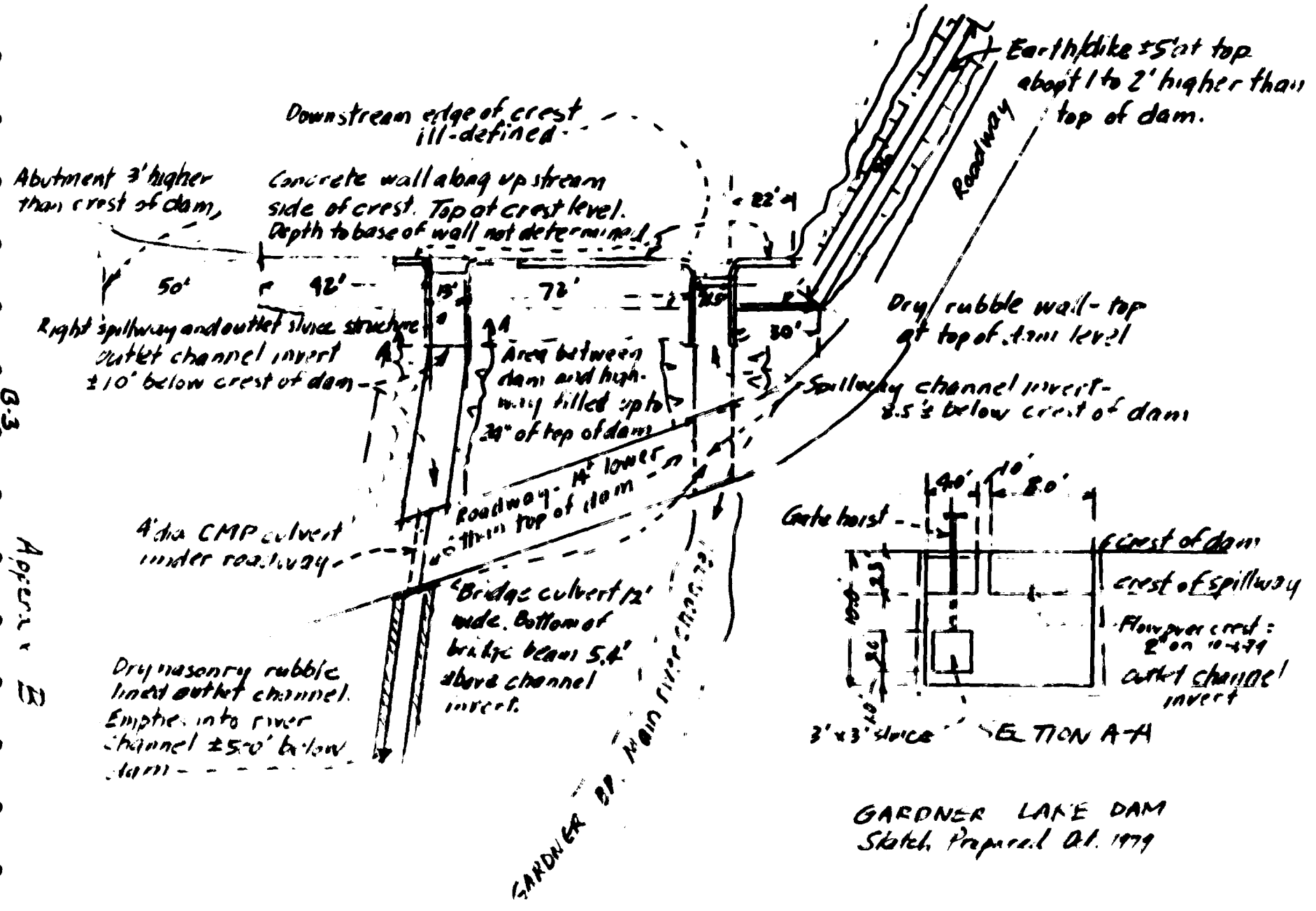
SEE OVER

Summary of File Data ______

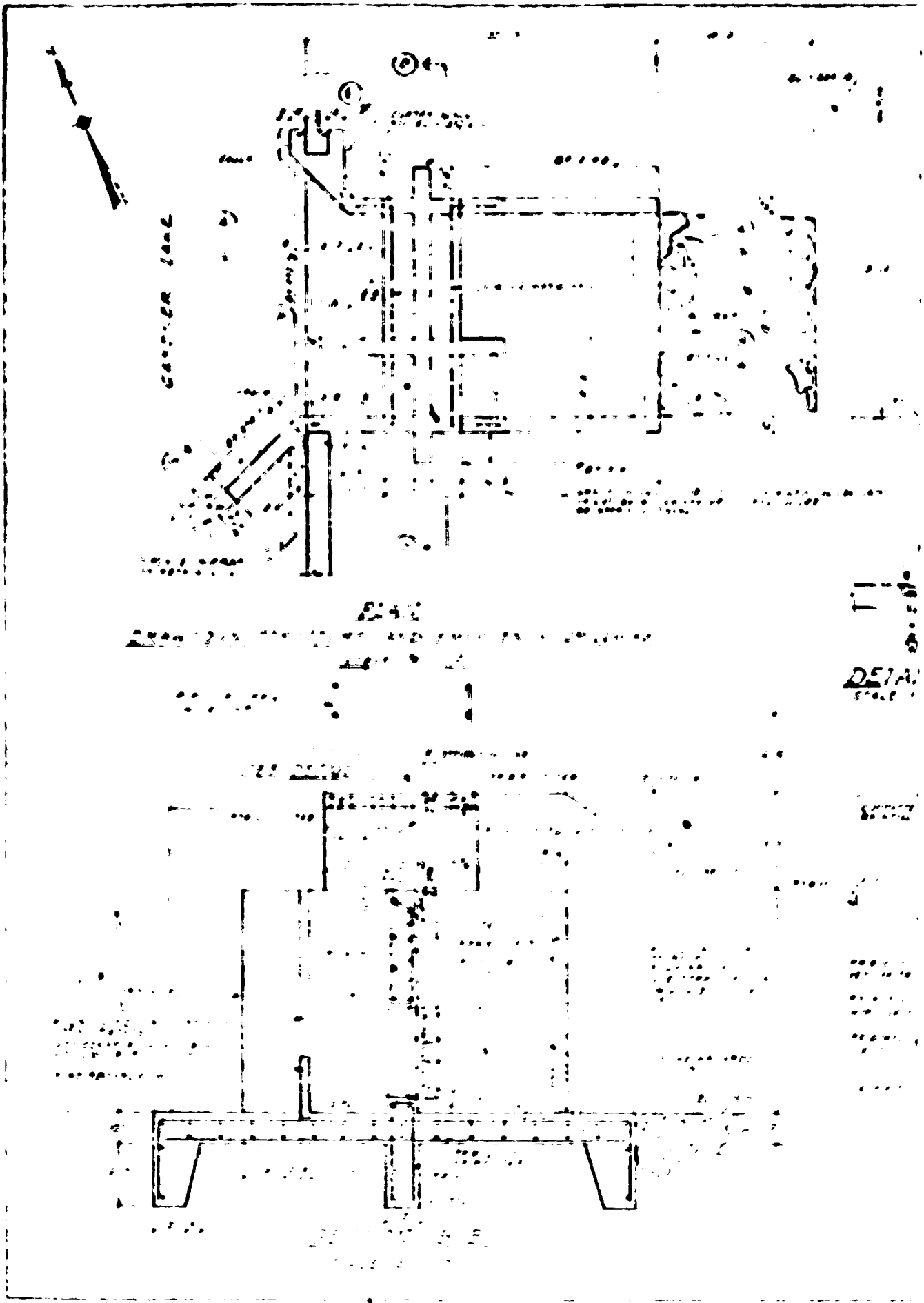
Remarks Water had been lowered 2' below spillway. See pictures showing deteriorated condition of concrete wall & gate structure

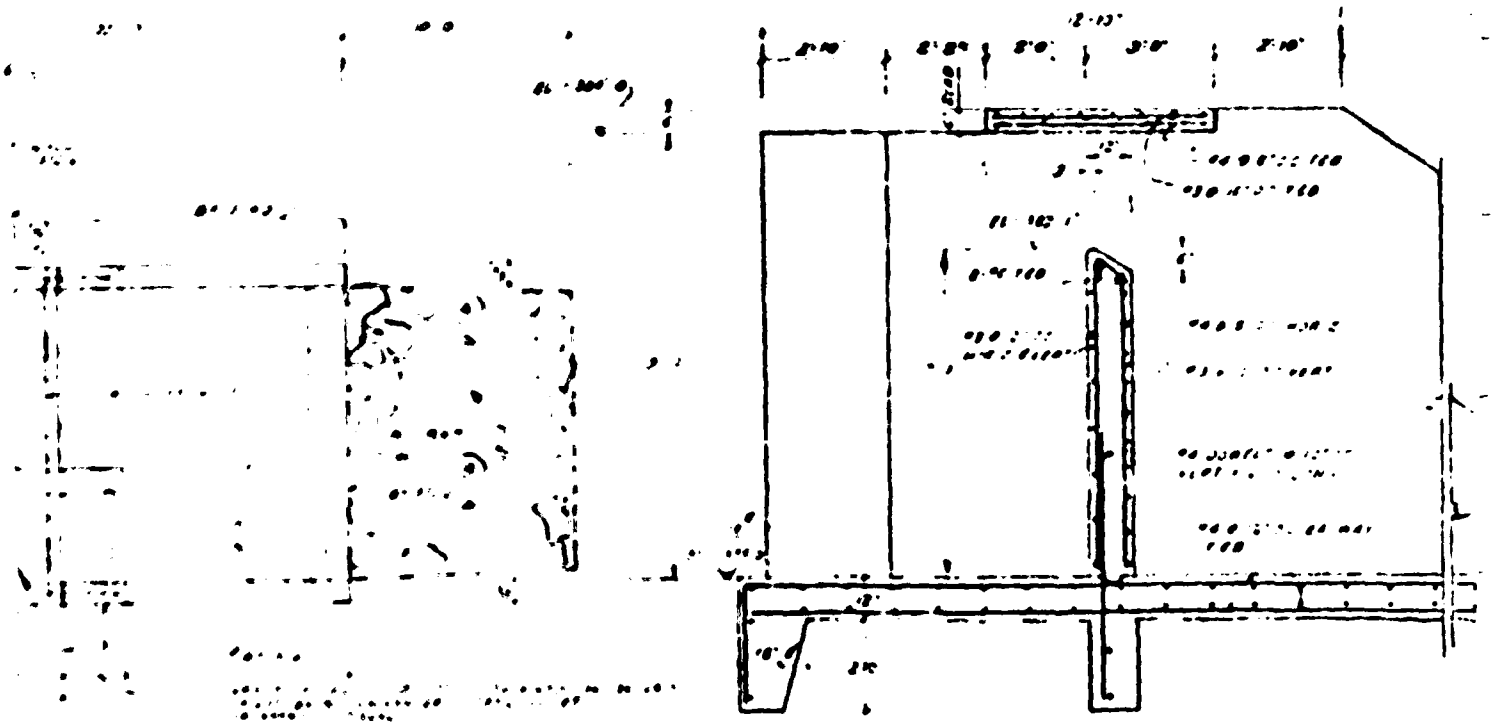
Would Failure Cause Damage? Doubtful   Class A

B-2



GARDNER LAKE DAM
Sketch Prepared Oct. 1979

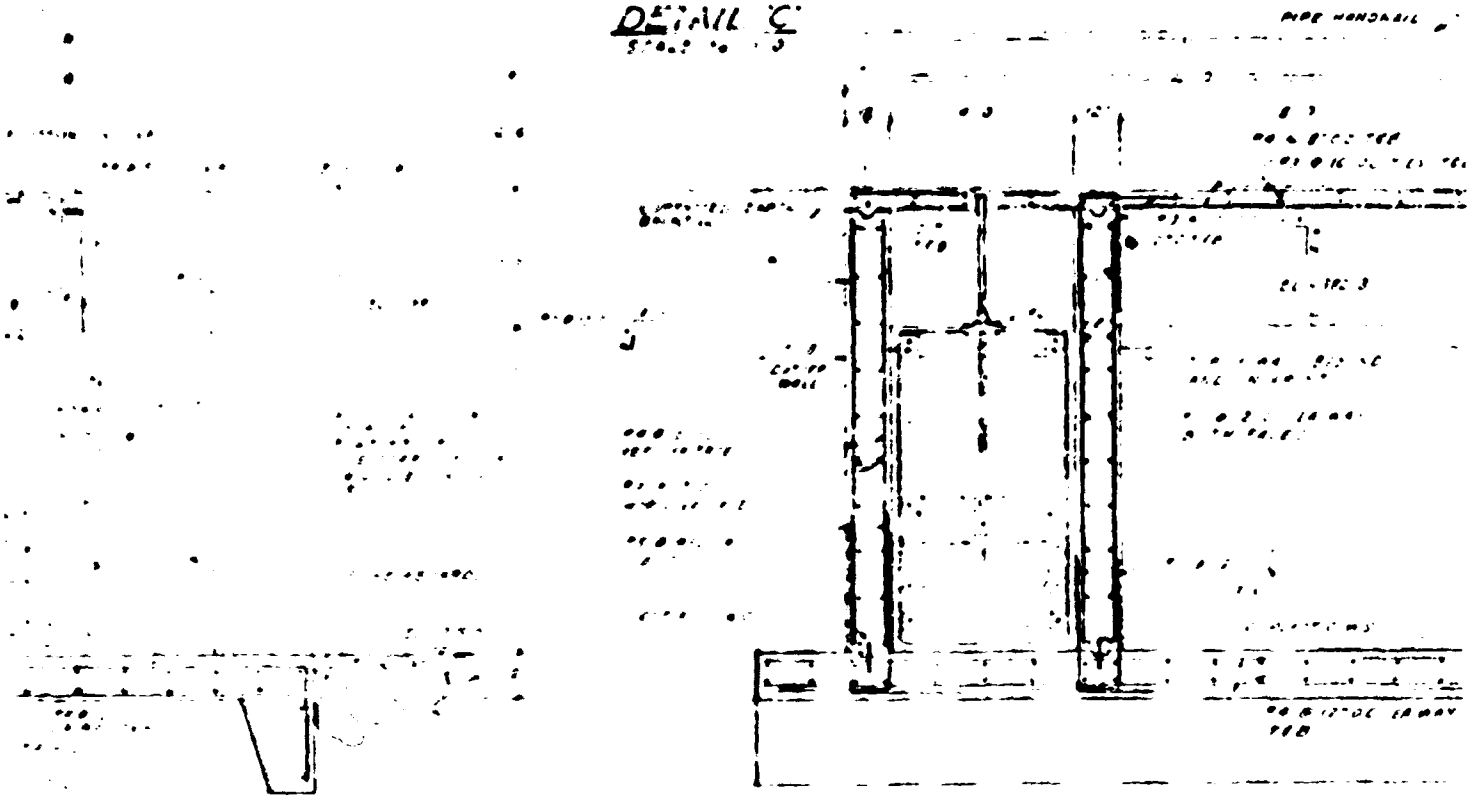




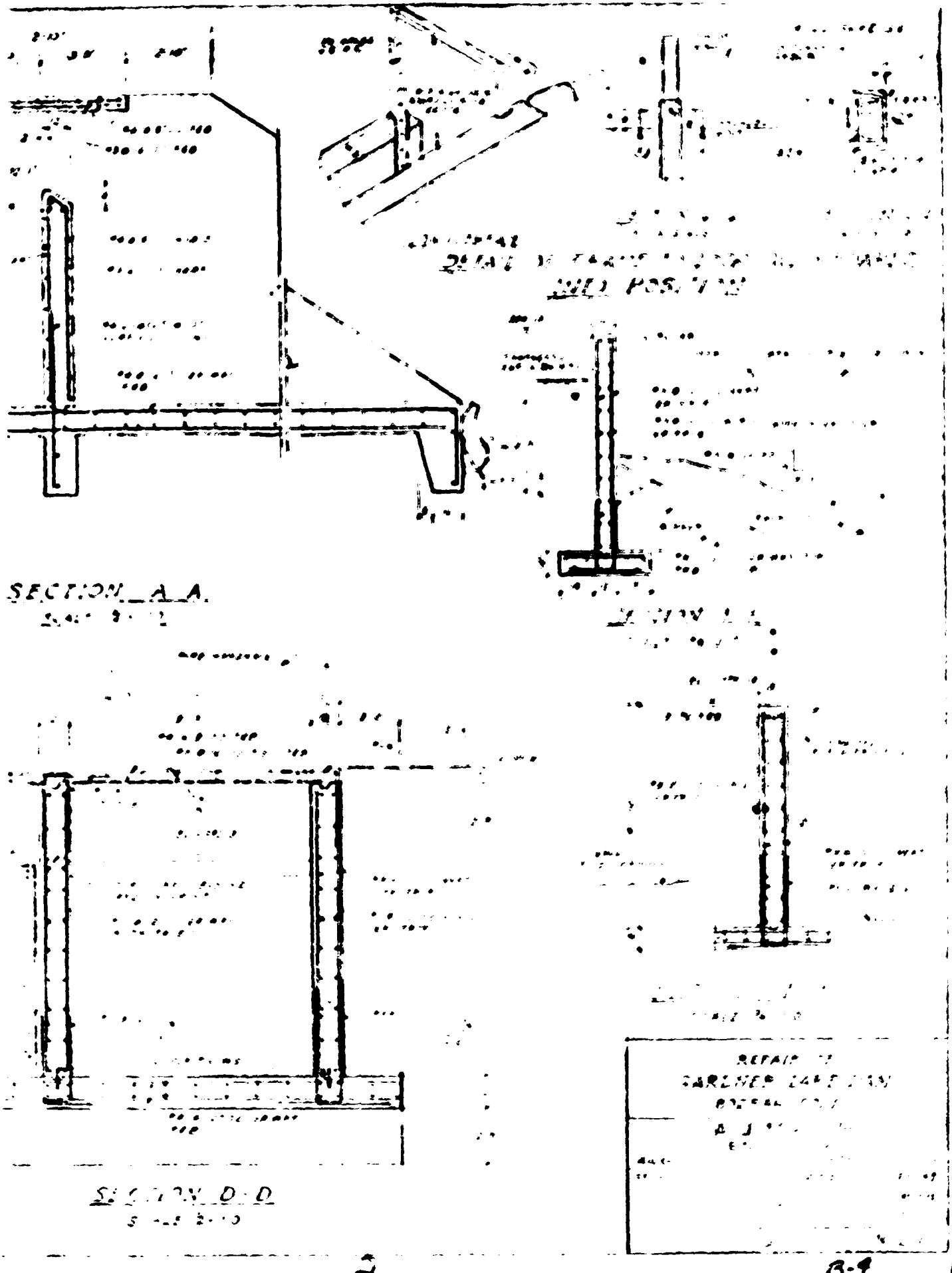
SECTION A-A

SCALE 3/4" = 1'-0"

DETAIL C



SECTION D-D

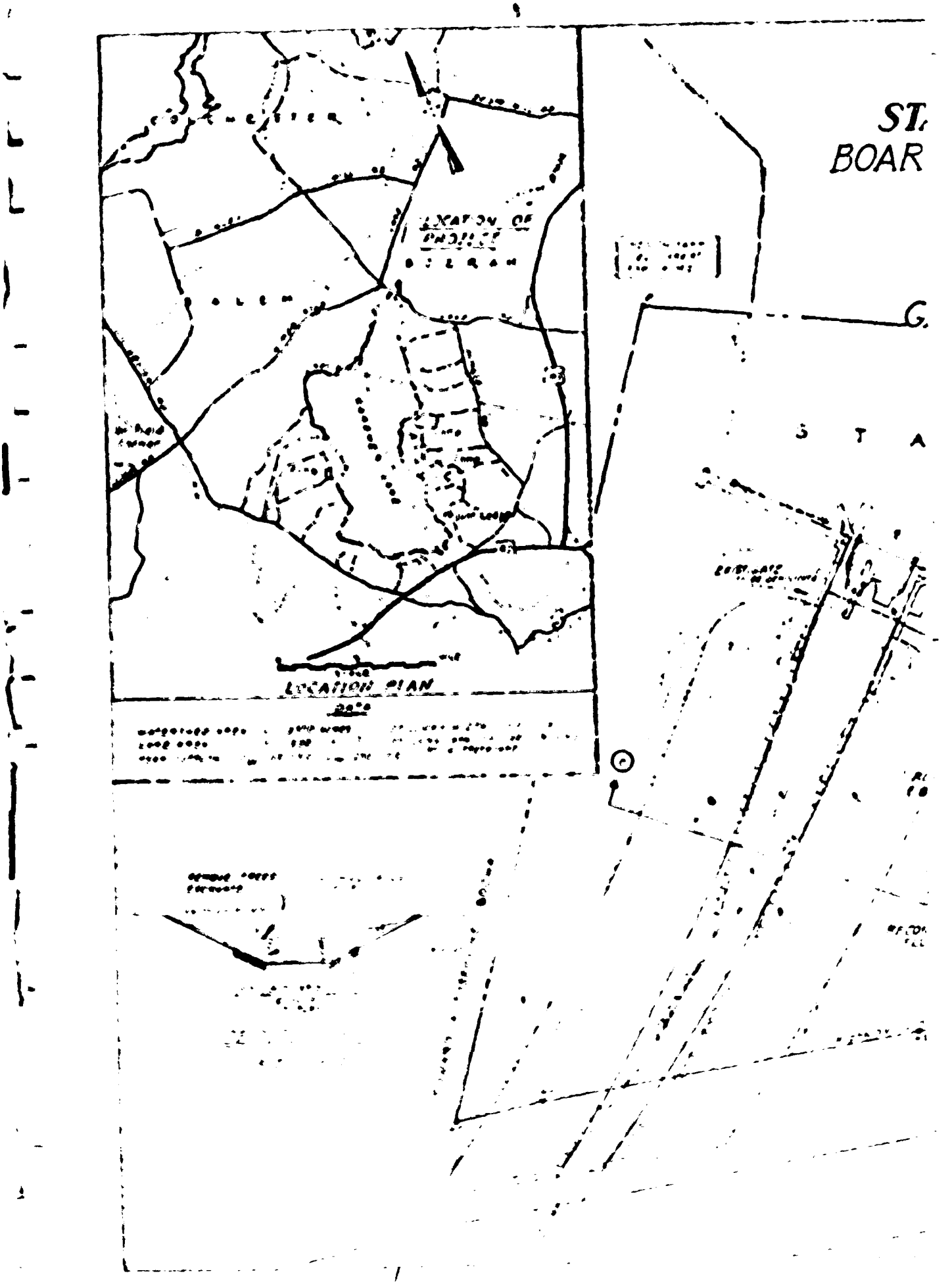


SECTION A-A

SECTION D-D

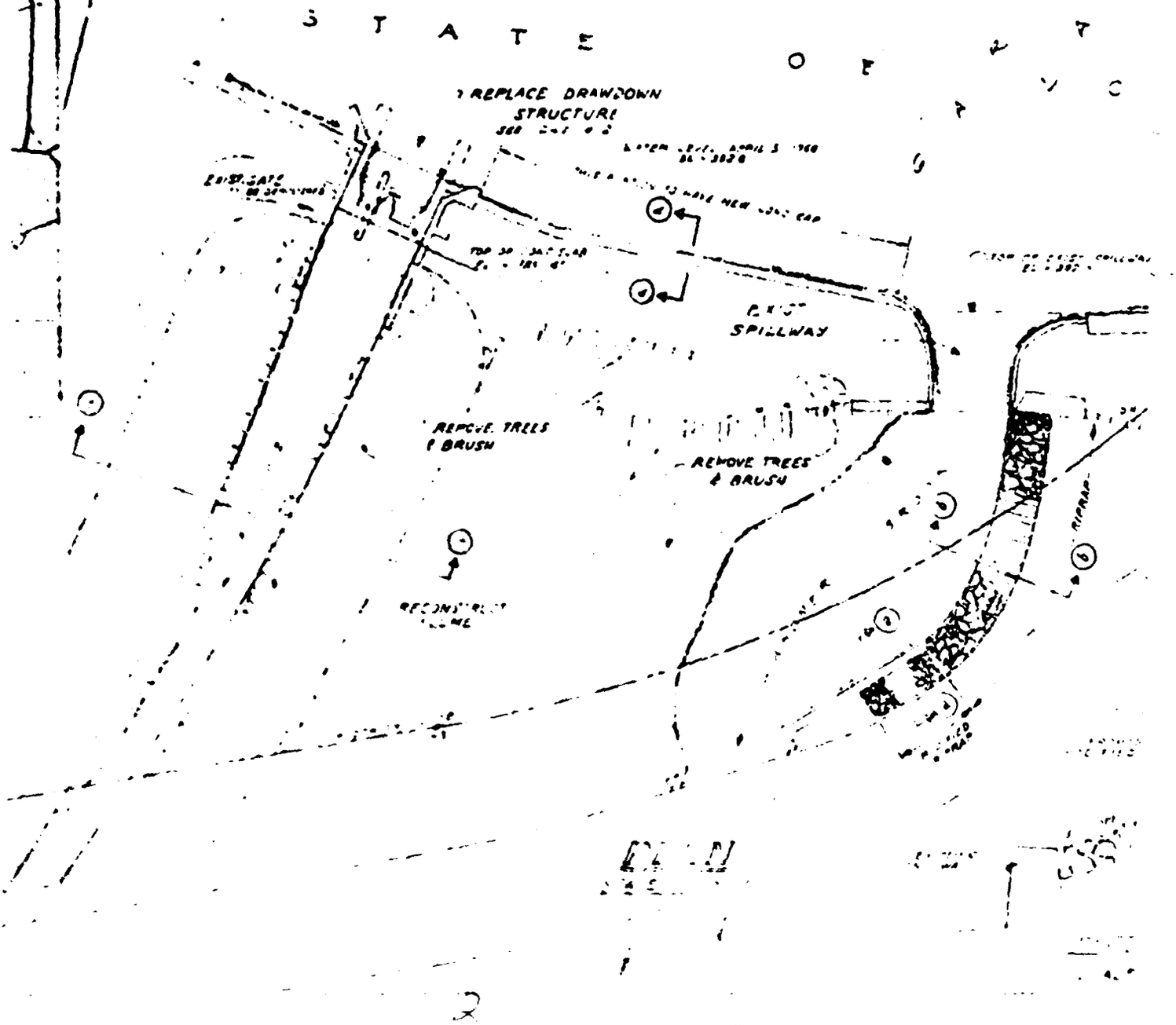
REPAIR OF
GARLINED CAISSON

B-9


ST.
BOAR
LOCATION PLAN

STATE OF CONNECTICUT
BOARD FISHERIES AND GAME

PLAN
FOR
REPAIR OF
GARDNER LAKE DAM
IN THE TOWN OF BOZRAH



VECTICUT
AND GAME.

STATE WATER RESOURCES
COMMISSION
RECEIVED
AUG 21 1969
ANSWERED
REFERRED
FILED

E DAM

OZRAH

EDWARD W. &
JOSEPHINE A. SOTIA

STATE OF CONNECTICUT

LAKE ROAD

RIPRAP

NEW CONC. CAP

SUPPLEMENTAL B.D.A.
TYPICAL SECTION
AT EXISTING DAM
SCALE: 1/2"=1'-0"
SECTION d-d

APPROVED
STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
BY
DATE

REPAIR OF
GARDNER LAKE DAM
BOZRAH CONN.

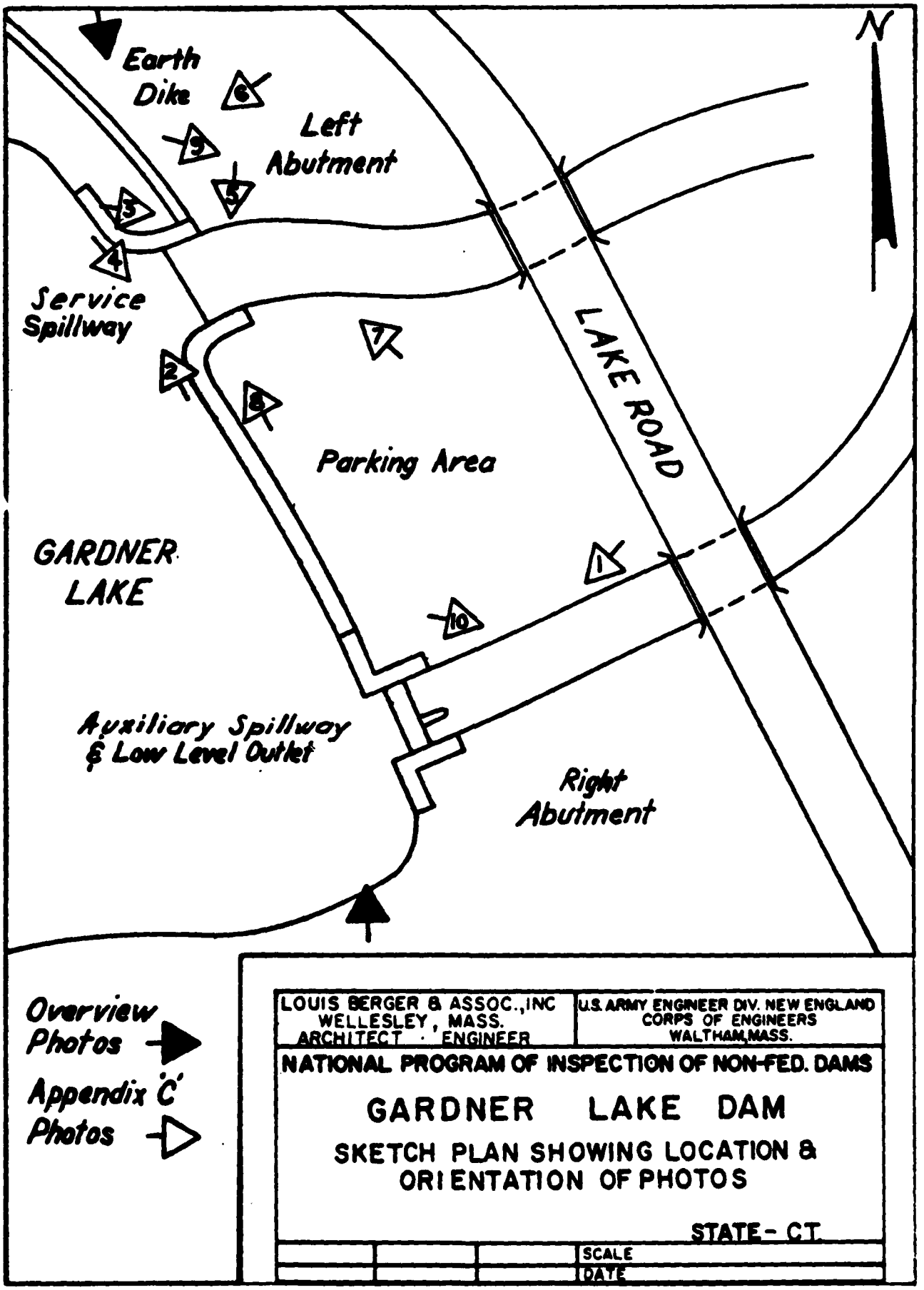
1 OF 2

3

B-5

APPENDIX C

PHOTOGRAPHS



Overview Photos →

Appendix 'C' Photos →

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

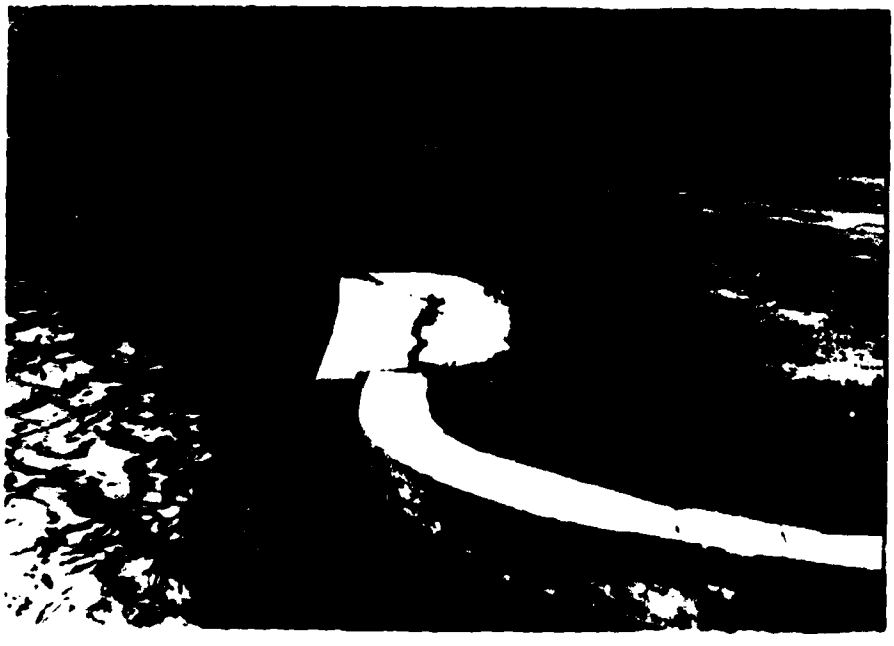
GARDNER LAKE DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE - CT

			SCALE
			DATE

1. Auxiliary spillway and regulating outlet



2. Deteriorated left training wall of service spillway

3. Potholes behind left training wall of service spillway

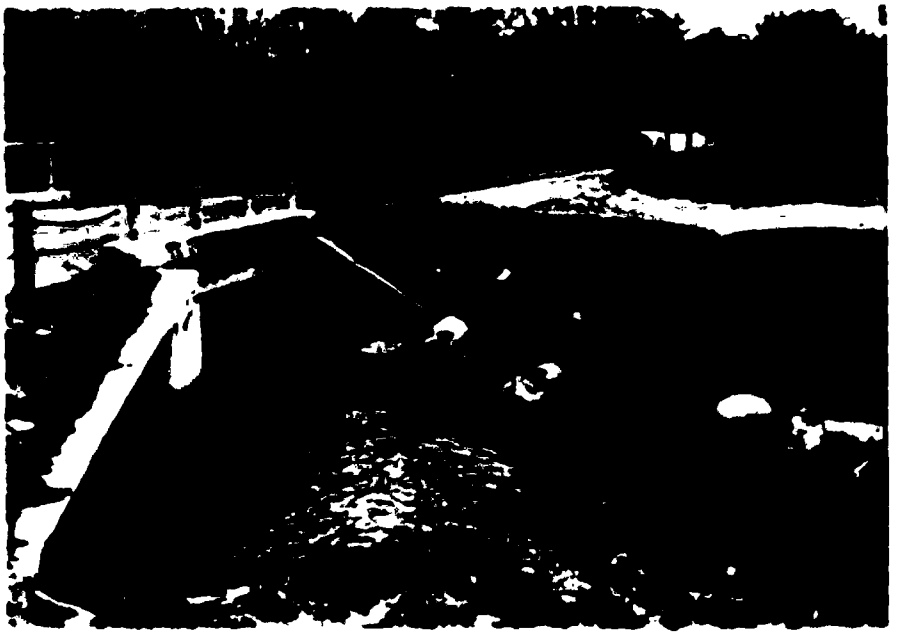
4. Deteriorated right training wall of service spillway

5. Right downstream masonry training wall of service spillway

6. Small earth dike and masonry wall on left abutment

7. View of service spillway

8. Low area behind right training wall of service spillway



9. Concrete box culvert carrying outlet channel for service spillway under Lake Road

10. Corrugated metal pipe and masonry arch carrying outlet channel for auxiliary spillway and low level outlet under Lake Road

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

BY JKH DATE 4/5/79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD BY DATE INSPECTION OF DAMS - Conn & RI PROJECT

SUBJECT GARDNERS LAKE - DRAINAGE AREA

FIND ENTIRE AREA ABOVE LAKE

PLANIMETER NO. 36[illegible]
INDEX @ 89.9
1.0 = 149.0

USGS Sheet	Ave Reading (sq in)
Fitchville, Conn	14.79
	9.22
Montville, Conn	4.39
Colchester, Conn	1.87
	39.27

Scale $(1")^2 = (2{,}000')^2$ 4,000,000 sq ft/sq mi

$$\text{Area} = \frac{39.27 \text{ sq in} \times 4{,}000{,}000 \text{ sq ft/sq mi}}{43{,}560 \text{ sq ft/Acre}} = \boxed{3{,}606.06 \text{ Acres}}$$

3,606.06 Acres ÷ 640 Acres/sq mi = [illegible]

BY RFB DATE 10-3-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ..... OF ...

CHKD BY ..... DATE ..... INSPECTION OF DAMS PROJECT .....

SUBJECT GARDNER LAKE - STORAGE CAPACITY CURVES

SURFACE AREA OF LAKE, ELEV 384

READ #2	12.54	READ #4	18.26	AVE. = 5.675 [III]
" #1	06.91	" #3	12.59	AREA = 521 ACRES
	5.63		5.67	

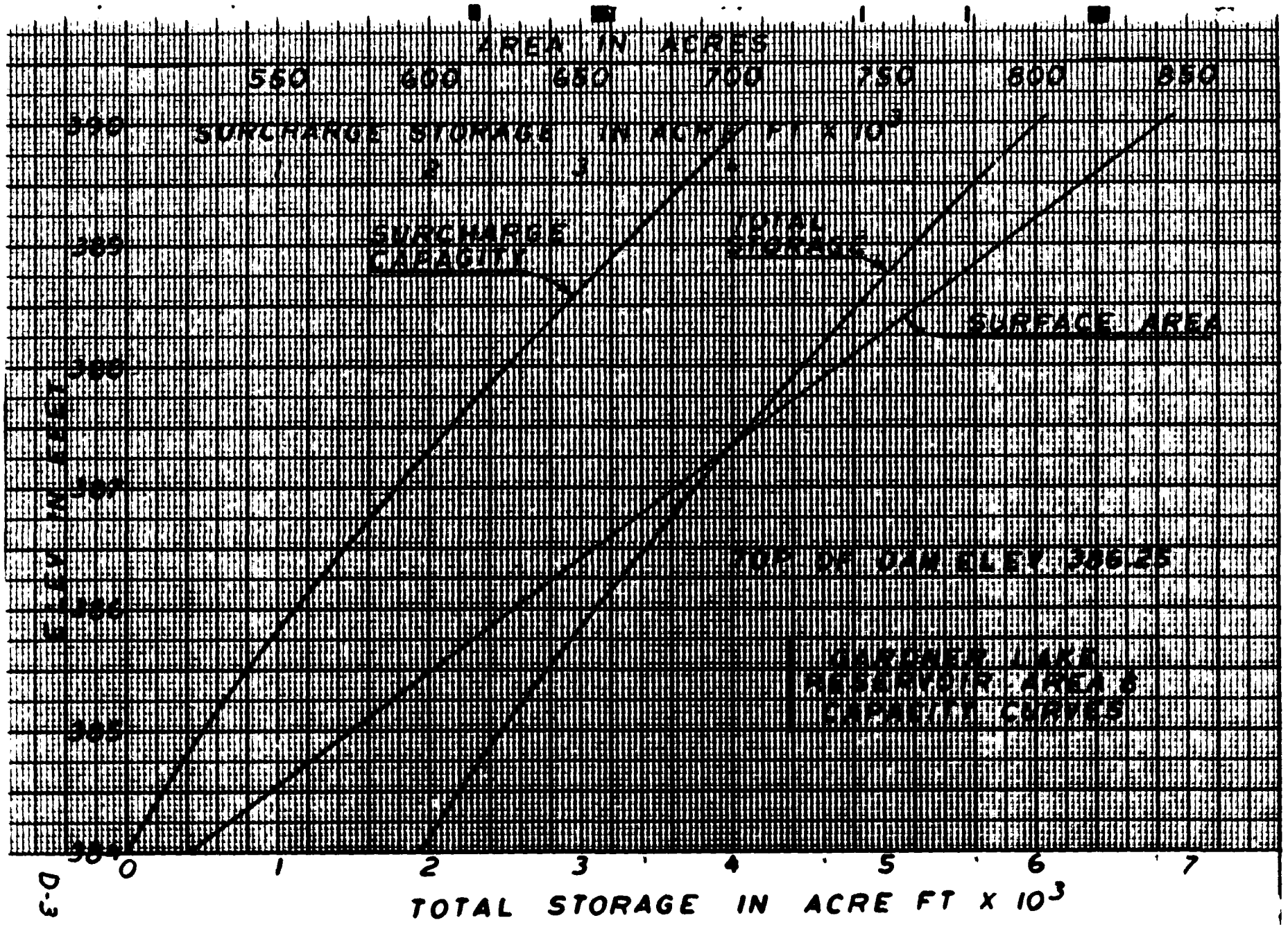
AREA AT ELEV. 390

READ #2	33.44	READ #4	42.58	AVE = 9.19 [III]
" #1	24.20	" #3	33.44	AREA = 844 ACRES
	9.24		9.14	

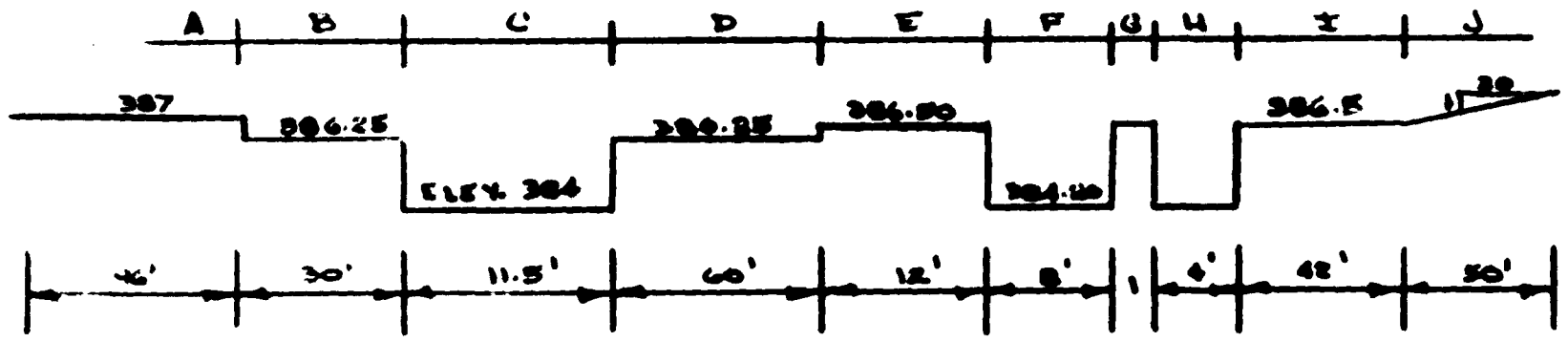
AREA AT ELEV 400

READ #2	76.74	READ #3	89.19	AVE = 12.40 [III]
" #1	64.40	" #4	76.74	AREA = 1139 ACRES
	12.34		12.45	

ELEV. FT	AREA ACRES	ΔH FT	SURCHARGE STORAGE	TOTAL STORAGE
384	521			1945
386	629	2	1150	3095
388	737	2	2516	4461
390	844	2	4097	6042
392	903	2	5844	7788
394	962	2	7709	9654
396	1021	2	9692	11637
398	1080	2	11793	13758
400	1139	2	14012	15957


AREA IN ACRES
560
600
650
700
750
800
850
SURCHARGE STORAGE IN ACRE FT X 10³
0
1
2
3
4
5
6
7
SURCHARGE CAPACITY
TOTAL STORAGE
SURFACE AREA
TOP OF DAM ELEV. 386.25
ELEVATION IN FEET
390
389
388
387
386
385
TOTAL STORAGE IN ACRE FT X 10³
D-3

BY RFB DATE 10-10-79 LOWRY BOOKER & ASSOCIATES INC. SHEET NO. 1 OF
CHKD BY DATE PROJECT
SUBJECT GARLAND LAKE DETENTION POND



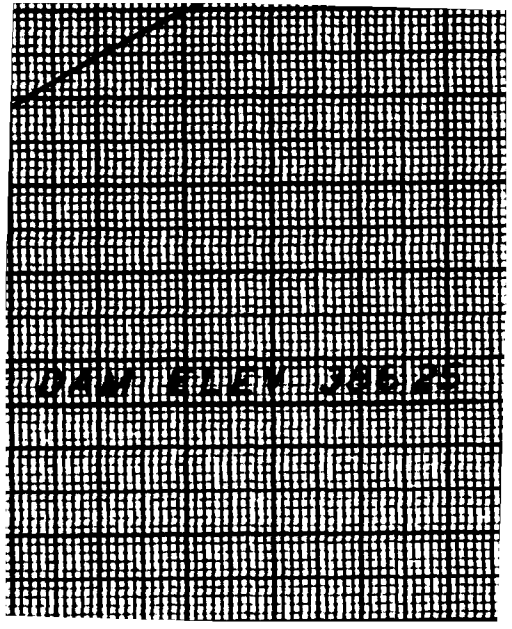
ELEV	A	C = 2.4		B+D	C = 2.6		C	C = 3.1		E+G+I	C = 2.6	
FT	L	H	Q	L	H	Q	L	H	Q	L	H	Q
385	46	0	0	90	0	0	11.5	1	36	85	0	0
386		0	0		0	0		2	109		0	0
386.25		0	0		0	0		2.25	120		0	0
386.50		0	0		.25	29		2.5	141		0	0
387		0	0		.75	152		3	185		.5	51
388		1	230		1.75	542		4	285		1.5	262
389		2	652		2.75	1067		5	599		2.5	565
390		3	1197		3.75	1699		6	524		3.5	936
391		4	1843		4.75	2482		7	660		4.5	1365
392		5	2576		5.75	3226		8	807		5.5	1844

BY RFB DATE 10-10-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF.

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT GARDNER LAKE DISCHARGE [illegible]

ELEV FT	F		C = 3.3		H		C = 3.2		J		C = 2.4		TOTAL Q
	L	H	Q		L	H	Q		L	H	Q		
385	0	.8	19		4	.8	9		0	0	0		64
386		1.8	64			1.8	31		0	0	0		204
386.25		2.05	77			2.05	36		0	0	0		235
386.50		2.30	92			2.30	45		0	0	0		307
387		2.8	124			2.8	60		10	.25	3		575
388		3.8	196			3.8	95		30	.75	47		1658
389		4.8	278			4.8	135		80	1.25	168		3264
390		5.8	369			5.8	179		→	2.25	405		5309
391		6.8	468			6.8	227			3.25	703		7688
392		7.8	575			7.8	279			4.25	1061		10358


DAM GLEN 3625

BY REB DATE 10-11-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE Inspection of Dams PROJECT

SUBJECT Gardner Lake, Reservoir Routing

Drainage Area = 5.63 sq.mi = 3606 Acres

Storage Capacity = 3130 Acre-ft

Height = 9.6 ft

Size Classification = Intermediate

Hazard Classification = Significant

Test Flood ½ PMF to PMF: Use ½ PMF

From Inflow Hydrograph ∴ PMF = 9200 cfs

½ PMF = 4600 cfs

Routing:

Step 1 Peak Flow = 4600 cfs

Step 2 a. Surcharge Height = 389.67

b. Volume of Surcharge = 3810 Acre-ft

$$Stor_1 = \frac{3810 \text{ Acre-ft}}{3606 \text{ Acres}} \times 12 \text{ in/ft} = 12.68 \text{ inches}$$

c. $Q_{p2} = Q_{p1} \times \left(1 - \frac{Stor_1}{9.5}\right)$

c. $Q_{p2} = 4600\left(1 - \frac{12.68}{9.5}\right)$

c $Q_{p2} = 0$

Use Graphical Solution

D-7

BY RFB DATE 10-2-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT GARDNER LAKE, INFLOW HYDROGRAPH

DRAINAGE AREA = 5.63 MI^2 = 3603 ACRES

RESERVOIR AREA @ ELEV 384 = 0.81 MI^2 = 518 ACRES
14% OF TOTAL

USE 100% OVERLAND FLOW

NOW LONGEST LENGTH OF WATER COURSE, L = 12,400'
L = 2.35 MI

Δ ELEV DIFFERENCE = 460 - 384 = 76

$\therefore$ SLOPE = $\frac{76}{2.35}$ = 32.3 FT/MI & $\sqrt{S}$ = 5.68

NOW $\frac{LL_c}{\sqrt{S}} = \frac{(2.35)(2.35)}{2\sqrt{32.3}} = 0.486$

$\left(\frac{LL_c}{\sqrt{S}}\right)^{.33} = (0.486)^{.33} = 0.788$

LAG = $K\left(\frac{LL_c}{\sqrt{S}}\right)^{0.33} = 0.788K$

ASSUME K = 5.0 HRS (REFER TO "CURVE B", MOUNTAINOUS REGION, MIXED TERRAIN, BOR REC

LAG = 5.0 (0.788) = 3.94 HRS

$T_p = 0.41D + 0.82$ LAG, D = 1.0 HRS

$T_p = 0.41(1) + 0.82(3.94)$

$T_p = 0.41 + 3.23 = 3.64$ HRS

CHECK VELOCITY $T_c = \frac{T_p - .5D}{0.6} = 2.81$ HRS

$V = \frac{L}{T_c(3600)} = \frac{12,400}{(2.81)(3600)} = 1.23$ FT/SEC O.K

D-8

$T_R = 1.67\ T_P = 1.67(3.64) = 6.08$ HRS

$T_B = T_P + T_R = 3.64 + 6.08 = 9.72$ HRS

---

q_p = PEAK RATE IN CFS

$q_p = \frac{484\,A\,Q}{T_P}$ A = DRAINAGE AREA
Q = RUNOFF IN INCHS

$q_p = \frac{484(5.63)(1)}{3.64} = 749$ CFS

PMP = PROBABLE MAXIMUM PRECIPITATION

= 24"(.08) = 19.2" FOR CONNECTICUT

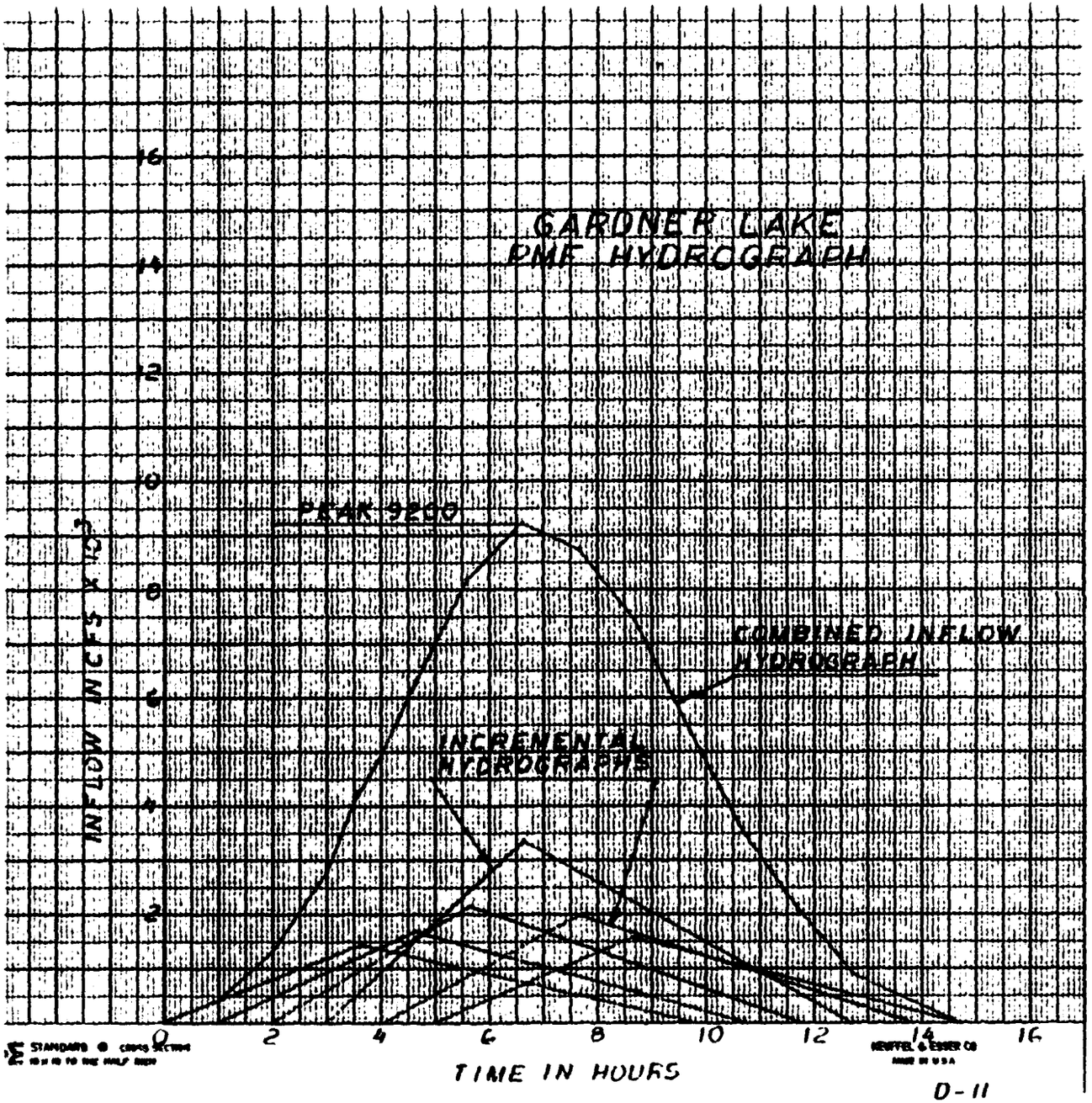
= 18.8" CONSIDERING INFILTRATION FOR OVERLAND FLOW

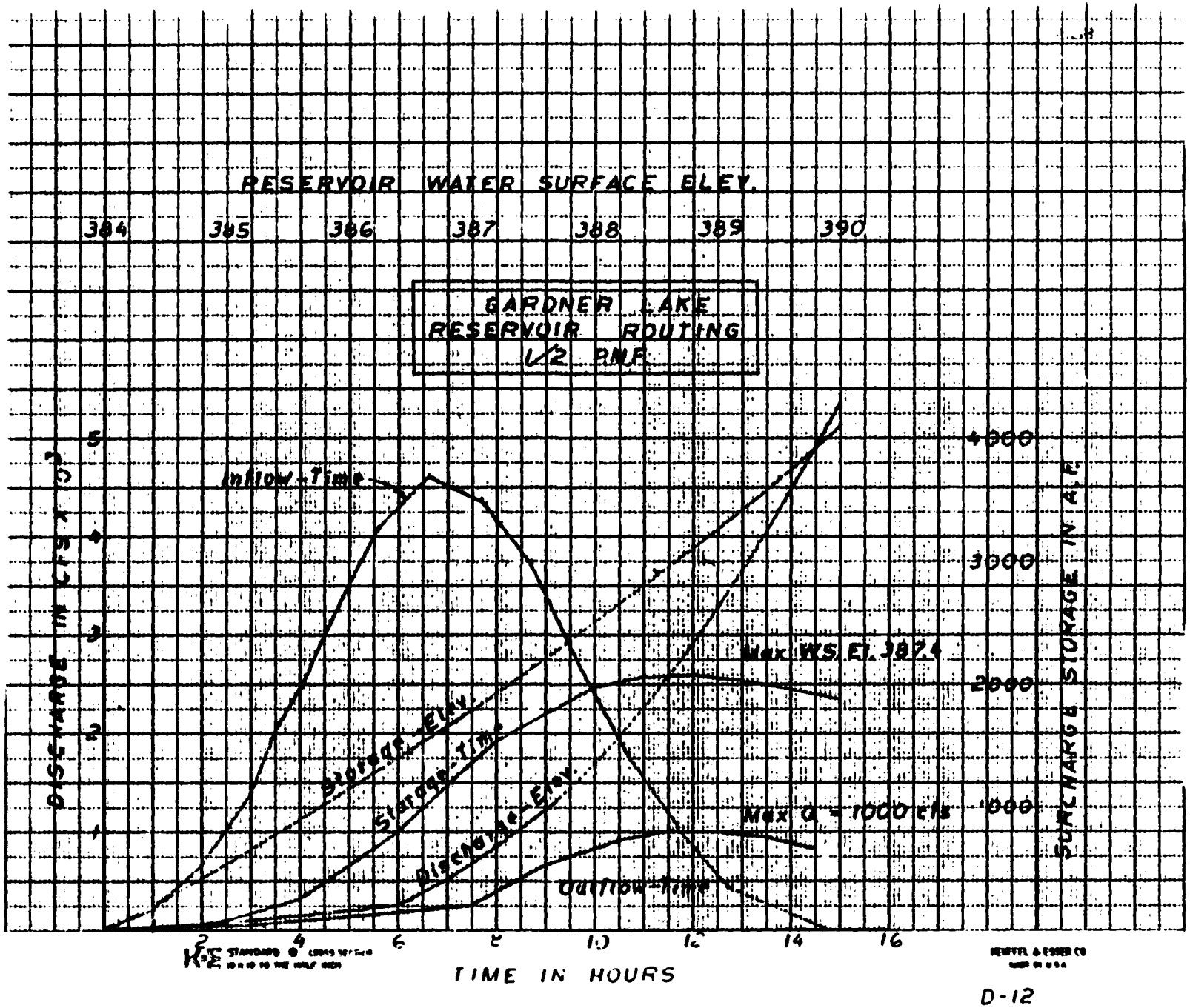
FLOOD HYDROGRAPH FOR PMF q_p = 749

TIME HOURS	RAINFALL %	RAINFALL INCHS	Q_s CFS	TIME BEGIN	TIME PEAK	TIME END
0.0	-	-				
1.0	10	1.88	1409	0	3.64	9.72
2.0	12	2.26	1692	1.0	4.64	10.72
3.0	15	2.82	2112	2.0	5.64	11.72
4.0	38	7.14	5348	3.0	6.64	12.72
5.0	14	2.63	1970	4.0	7.64	13.72
6.0	11	2.07	1550	5.0	8.64	14.72

* DISTRIBUTION OF MAXIMUM 6 HOUR SFS OR PMP IN PERCENT OF 6 HOUR AMOUNT PER

EM 110-2-1411


GARDNER LAKE
PMF HYDROGRAPH
PEAK 9200
COMBINED INFLOW HYDROGRAPH
INCREMENTAL HYDROGRAPHS
INFLOW IN CFS x 10³
16
14
12
10
8
6
4
2
0
2
4
6
8
10
12
14
16
TIME IN HOURS


RESERVOIR WATER SURFACE ELEV.
384
385
386
387
388
389
390
GARDNER LAKE
RESERVOIR ROUTING
1/2 PMF
Inflow-Time
Storage-Elev.
Storage-Time
Discharge-Elev.
Outflow-Time
Max W.S. El. 387.4
Max Q = 1000 cfs
1000
2000
3000
4000
SURCHARGE STORAGE IN A.F.
DISCHARGE IN CFS x 10³
1
2
3
4
5
2
4
6
8
10
12
14
16
TIME IN HOURS

BY REB DATE 10-11-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT GARDNER LAKE, FAILURE ANALYSIS

STEP 1 RESERVOIR STORAGE AT FAILURE = 3230

ASSUME WATER AT ELEV. 386.25

H = 9.6 FT

W = 40% OF 168 FT = 67 FT

STEP 2 PEAK FAILURE OUTFLOW

$$Q_{P_1} = 8/27\, W \sqrt{g}\, y_o^{3/2}$$

$$Q_{P_1} = 1.68\, W\, y_o^{3/2}$$

$$Q_{P_1} = 1.68\,(67)(9.6)^{3/2}$$

$$Q_{P_1} = 3348 \text{ CFS}$$

ADD SPILLWAY FLOW

@ ELEV 386.25 $\Rightarrow$ $Q_{SPILLWAY} = 220$

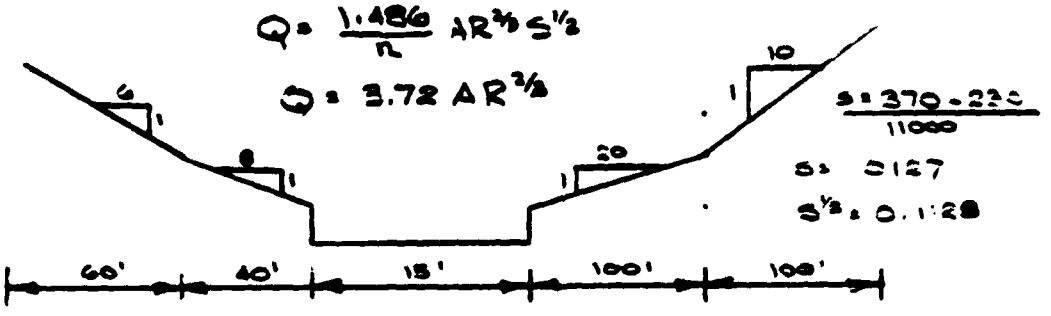
TOTAL Q = 3348 + 220 = 3568 CFS

SECTION BETWEEN LAKE RD & SCOTT HILL RD

$n = 0.045$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$Q = 3.72\, A R^{2/3}$$



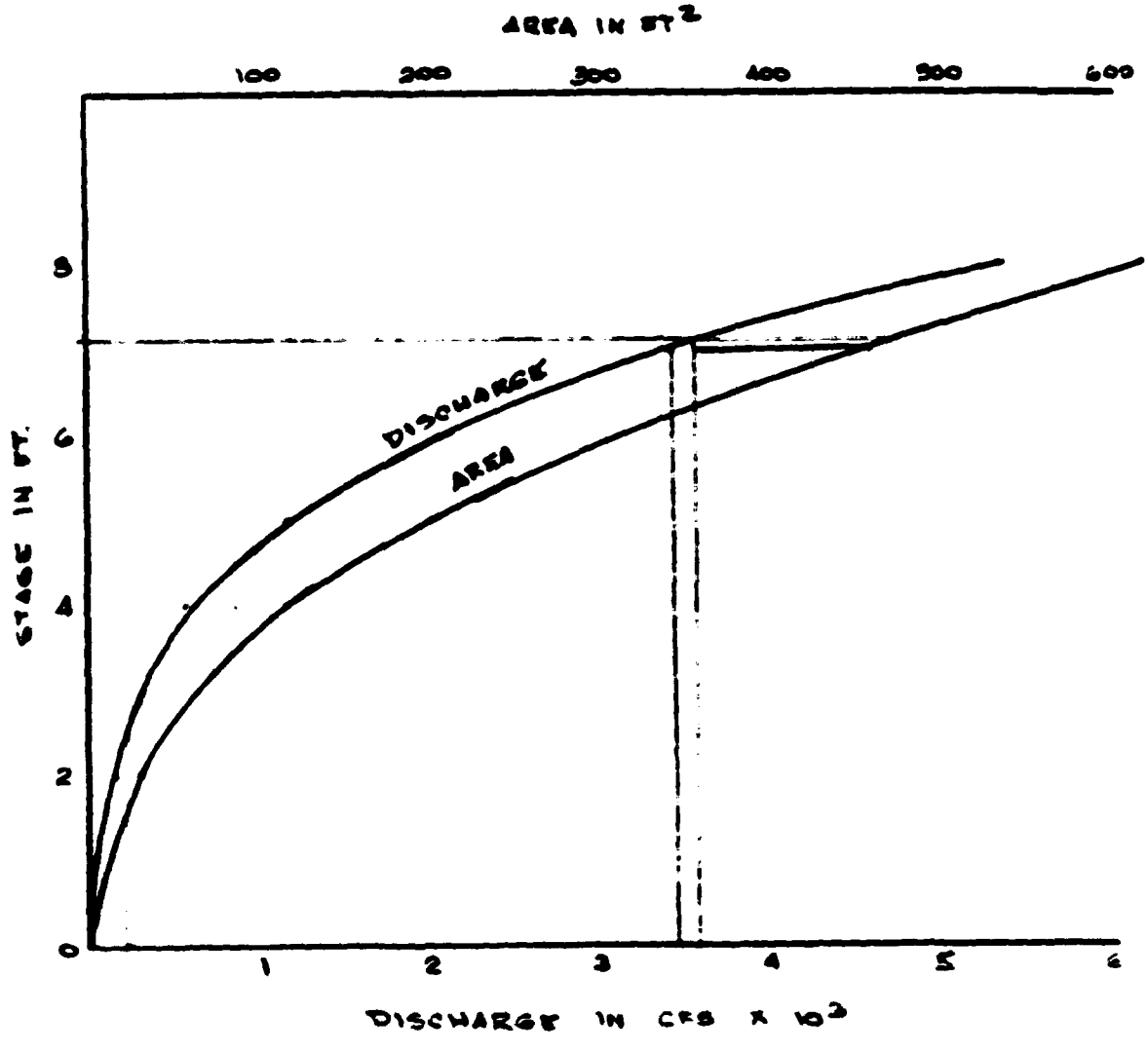
$S = \frac{370 - 230}{11000}$

$S = 0.127$

$S^{1/2} = 0.1128$

BY RF3 DATE 10-12-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF
CHKD. BY DATE Inspection of Dams PROJECT
SUBJECT Gardners Lake, Failure Analysis

DEPTH	Δ AREA	Σ AREA	WP	R	$R^{2/3}$	Q
2	30	30	19	1.58	1.36	182
4	86	116	75.2	1.54	1.34	587
5		201	103.3	1.95	1.56	1166
7		455	159.4	2.85	2.01	3402
8	163	618	175.8	3.52	2.32	5834



STEP 1 RESERVOIR STORAGE = 3230 ACRE-FT

STEP 4 a Q_{p1} = 3568 CFS

STAGE = 7.2 FT, AREA = 475' VOL = 120

b $Q_{p2\,(TRIAL)} = Q_{p1}\left(1 - \frac{120}{3230}\right)$

$Q_{p2\,(TRIAL)} = 3568(1-.037)$

$Q_{p2\,(TRIAL)} = 3436$

c FOR Q = 3436, STAGE = 7.0, AREA = 458

d V_2 = 116 V_{AVG} = 118

$Q_{p2} = 3568\left(1 - \frac{118}{3230}\right) = 3568(1-.037)$

Q_{p2} = 3436, STAGE = 7.0 FT

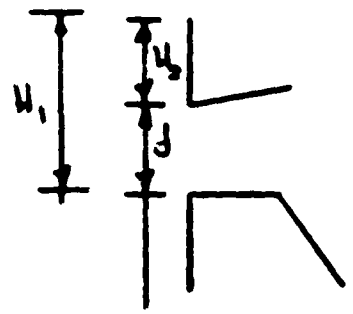
FOR $Q_{SPILLWAY}$ = 220 STAGE = 2.25

ΔH = 4.75 FT

BY RFB DATE 10-24-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT GARDNER LAKE DAM - LOW LEVEL OUTLET



$$Q = \tfrac{2}{3}\sqrt{2g}\, C L \left(H_1^{3/2} - H_2^{3/2}\right)$$

$L = 3.0$ ft

$\tfrac{2}{3}\sqrt{2g}\, L = 16.05$

WHEN WATER LEVEL IS AT TEST FLOOD ELEV 387.4

$d = 8.0'$ $H_1 = 387.4 - 377.5 = 9.9$

$H_2 = 9.9 - 3.0 = 6.9$

$\frac{d}{H_1} = \frac{8}{9.9} = .808$ From D.S.D. pg 386, $C = 0.692$

$Q = (16.05)(.692)\left(9.9^{3/2} - 6.9^{3/2}\right) = 11.04\,(31.15 - 18.12)$

$Q = 11.04(13.03) = 143.9$ CFS

WHEN WATER IS AT TOP OF DAM, ELEV 386.25

$d = 8.0$ FT $H_1 = 386.25 - 377.5 = 8.75$ FT

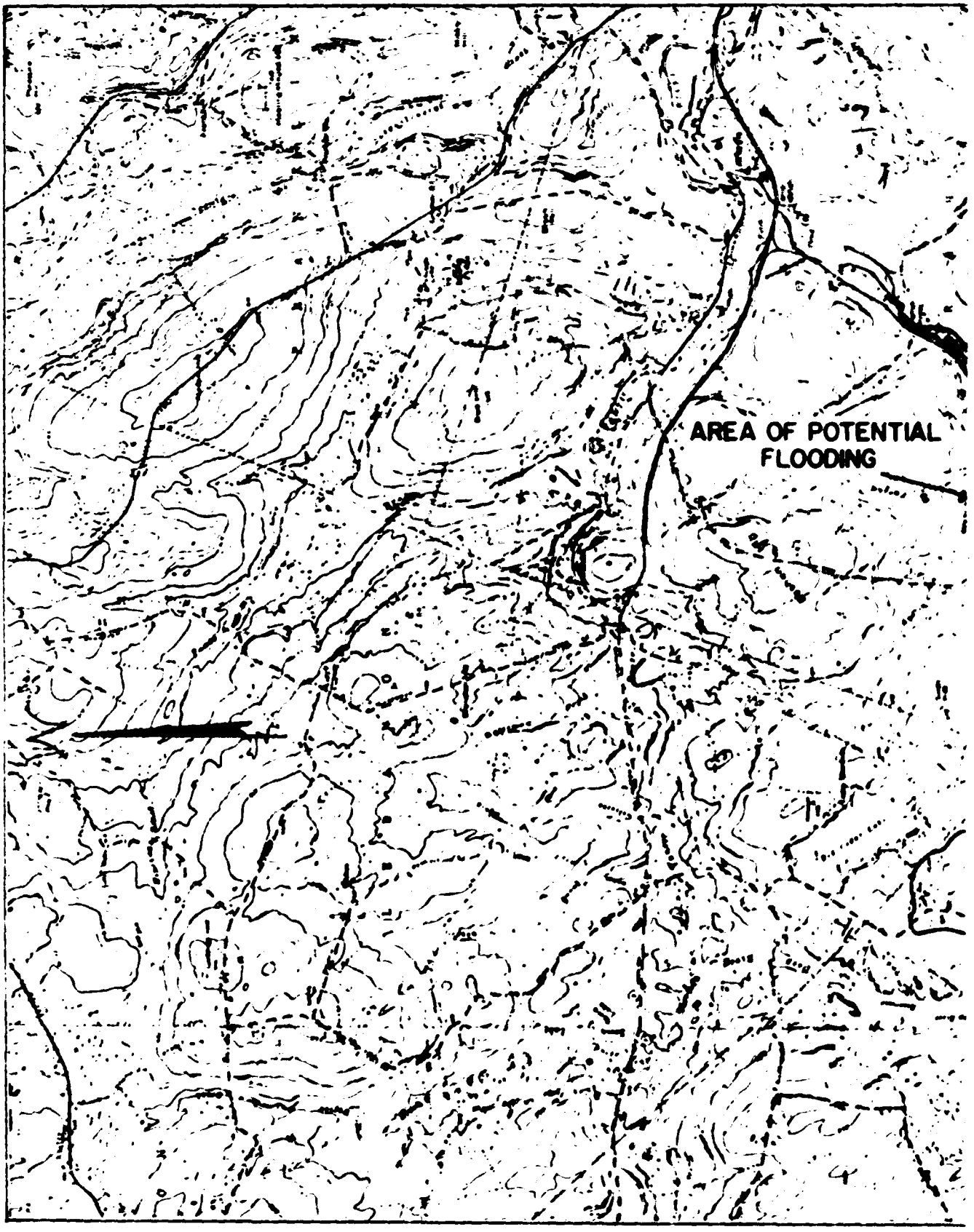
$H_2 = 8.75 - 3.0 = 5.75$ FT.

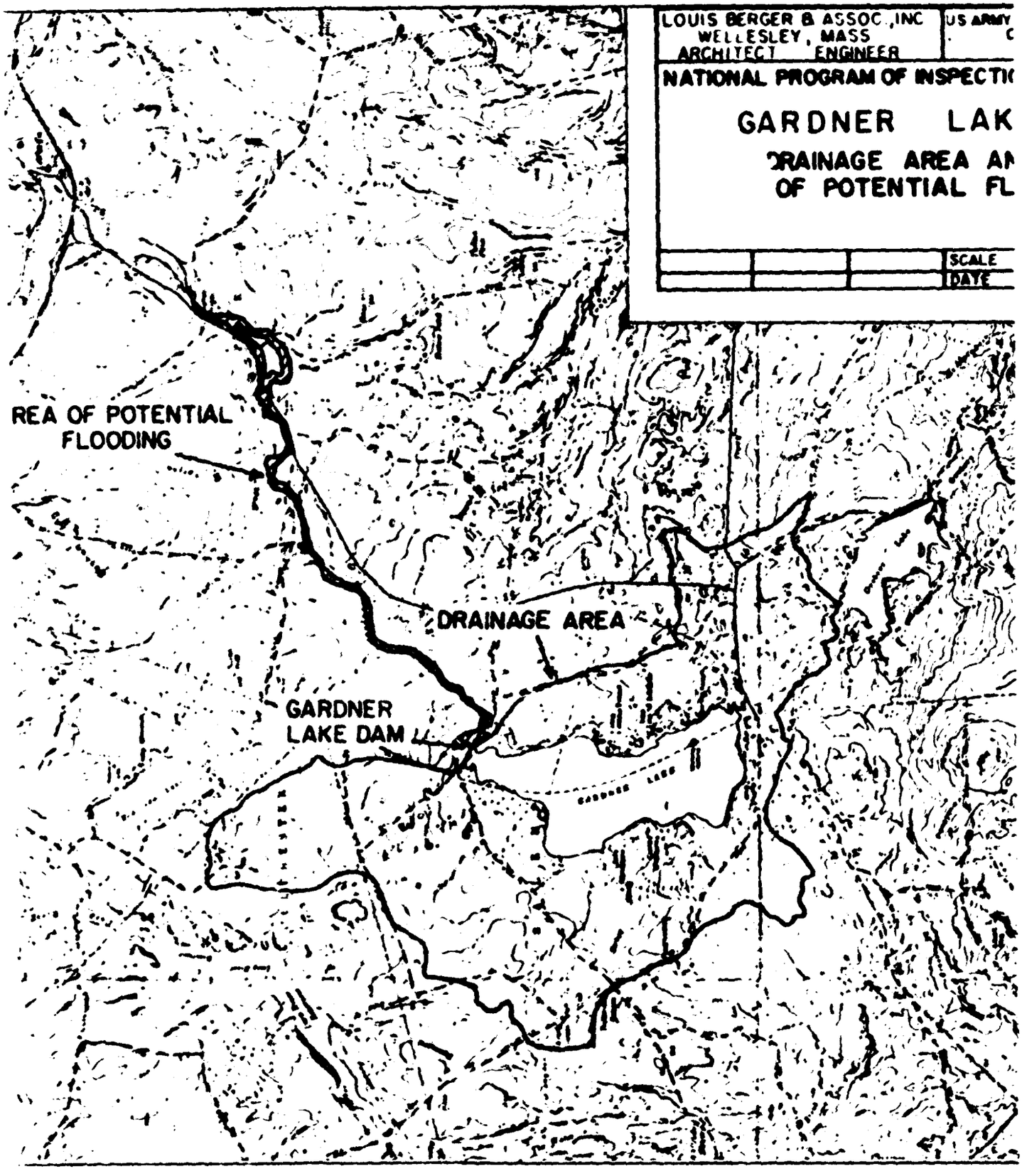
$\frac{d}{H_1} = \frac{8}{8.75} = 0.913$ From D.S.D. pg 386, $C = 0.683$

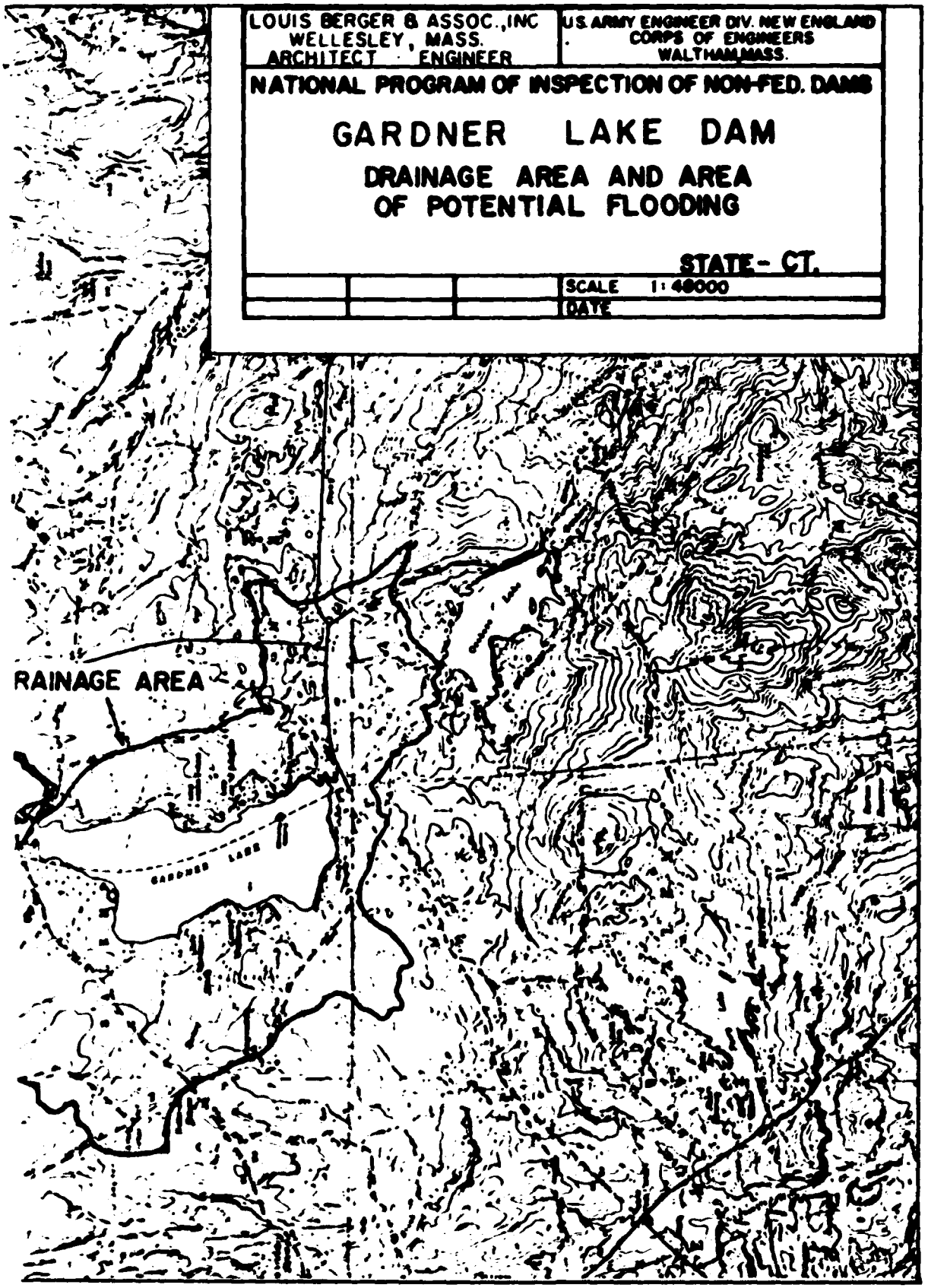
$Q = (16.05)(0.683)\left(8.75^{3/2} - 5.75^{3/2}\right)$

$= 10.96\,(25.88 - 13.79) = 10.96\,(12.09)$

$Q = 132.6$ CFS


AREA OF POTENTIAL
FLOODING


LOUIS BERGER & ASSOC., INC
WELLESLEY, MASS
ARCHITECT ENGINEER
US ARMY
NATIONAL PROGRAM OF INSPECTI
GARDNER LAK
DRAINAGE AREA AN
OF POTENTIAL FL
SCALE
DATE
REA OF POTENTIAL
FLOODING
DRAINAGE AREA
GARDNER
LAKE DAM


LOUIS BERGER & ASSOC., INC
WELLESLEY, MASS.
ARCHITECT ENGINEER
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
GARDNER LAKE DAM
DRAINAGE AREA AND AREA
OF POTENTIAL FLOODING
STATE - CT.
SCALE 1:48000
DATE
RAINAGE AREA

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	FEDERAL DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
CT	512	NED	CT	011	02				GARDNER LAKE DAM	4131.5	7213.4	19	OCT	79

POPULAR NAME	NAME OF IMPOUNDMENT
	GARDNER LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	07	GARDNER BROOK	FITCHVILLE	5	600

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUC. HEIGHT (FT.)	HYDRAU. HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	INSPECTED BY DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1900	R	12	10	3270	1985	NED	N	N	N	: N	

REMARKS
20-ESTIMATED 22-ESTIMATED

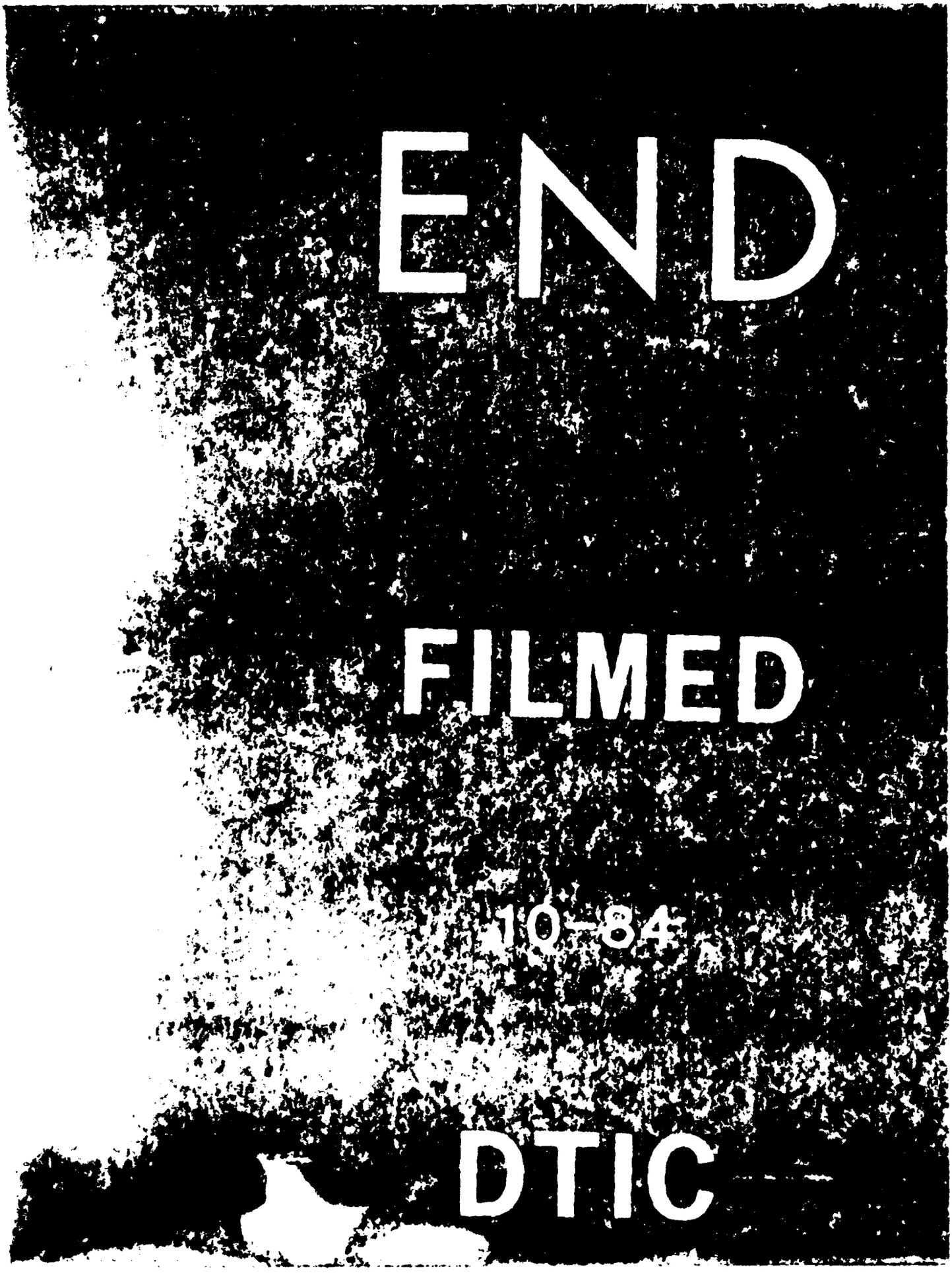
DAMS MAS	SPILLWAY LENGTH (FEET)	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PRESENT (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	168	U	28	235	5740											

OWNER	ENGINEERING BY	CONSTRUCTION BY
STATE OF CONNECTICUT		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
LOUIS BERGER & ASSOCIATES, INC.	09	OCT	79	PL92-367

REMARKS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10-84
DTIC